Rock Products

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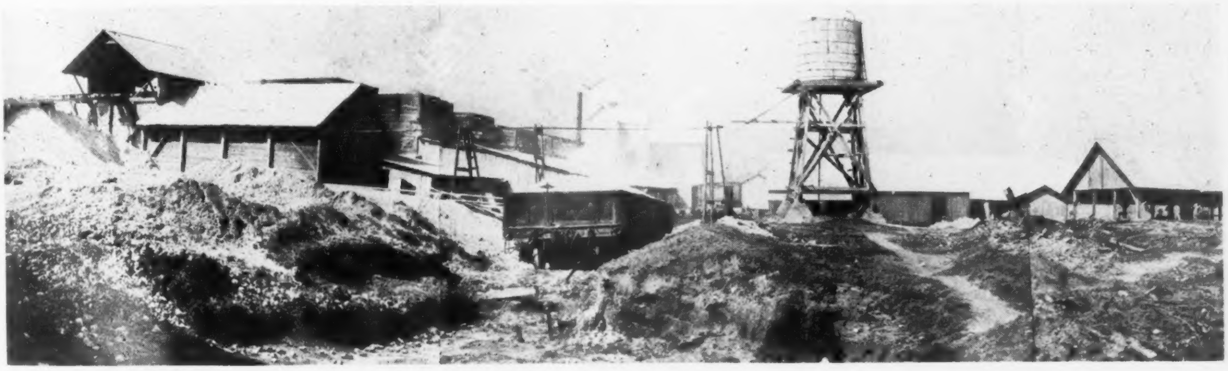
Burning Lime in Florida

The Commercial Lime Co., Ocala, Fla., Is One of the Most Aggressive in the South. Experiments with Oil Burning in Shaft Kilns Successful. Show Lime Can Be Produced Cheaper with Oil Than with Wood

THE plant and the pit of the Commercial Lime Co., are located on a 44-acre tract of limerock-bearing land near Reddick, Marion county, Fla., 13 miles north of Ocala—the heart of the only limerock district in Florida. The operation is served by the Atlantic Coast Line railway which makes connection with the Seaboard Air Line at Ocala. This gives the company all of Florida and southern Georgia and Alabama as its market.

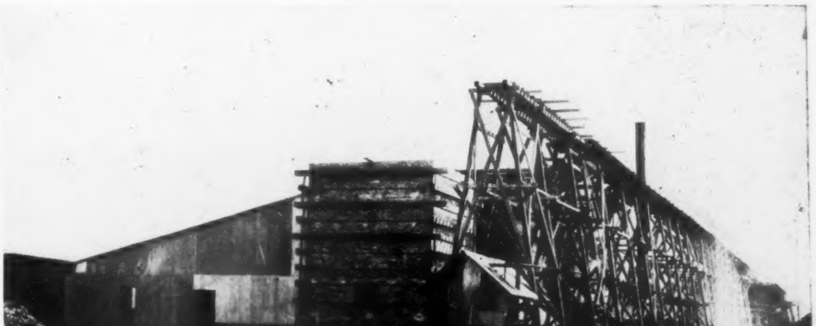


The building at the left is the agricultural plant; center, kilns and plant; at the right, the storage and cooper shops

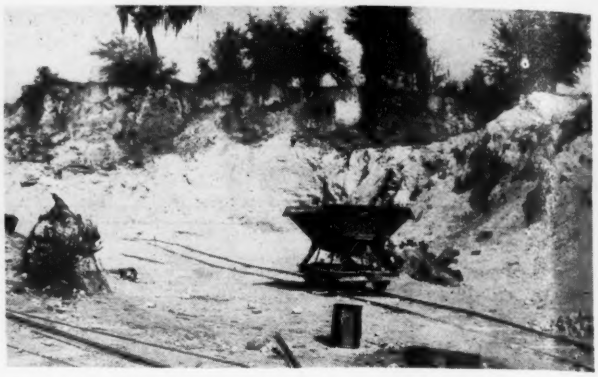
The Commercial company for the past several months has been making an extensive study of oil burning in shaft kilns, and in its experiments various processes and types of equipment have been tried which have embodied the use of all data available on the subject. However, very little information was available, and those in charge of the experiments had to shift for themselves. The final results of the experiments, though, showed that lime can be produced from 45 to 50 per cent cheaper with oil than with wood for fuel.

Much thought has been given the subject of oil burning in shaft kilns by lime producers over the entire country for the past few years. Many companies have conducted researches, which, if it were possible to obtain and compile the knowledge derived from them, would make up sufficient data to enable an operator contemplating an installation to know definitely what he was going about.

It has always been necessary for a producer considering the installation of oil-burning equipment to depend almost entirely upon the advice of manufacturers of such equipment for, as a rule, few disclosures are made by operators of the success or failure of their experiments. This, no doubt, has been because none of the experiments



In the foreground, one of the new type kilns. The trestle is in the course of reconstruction

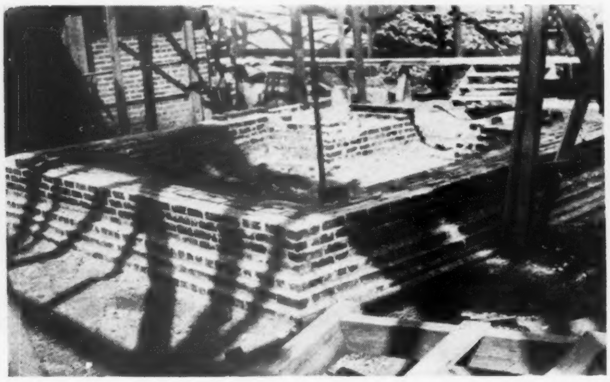
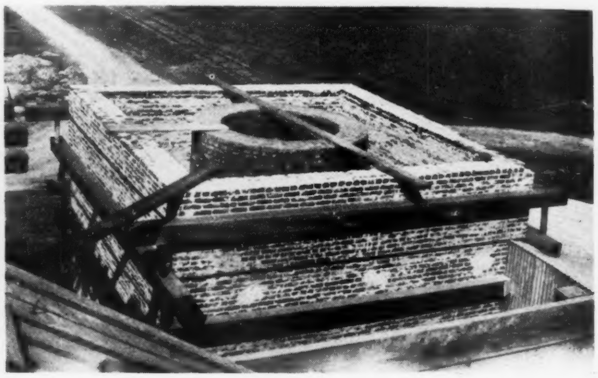
These views show each end of the quarry which is worked in a semicircle. The deposit is 48 ft. high and is clean to the top; the black part, which looks as though it were overburden, is a discoloration caused by overflowing rain water

have been wholly productive. Therefore, it is with appreciation that ROCK PRODUCTS receives from the Commercial Lime Co. some of the data covering comparative tests made at its plant.

Wood is used for fuel throughout Florida and the southern sections of Georgia and Alabama because it has always been available, and because the excessive freight rates on coal prohibit its use. But depletion of the wood supply is facing many operations, with the result that the price is gradually increasing as the supply is diminishing. It is evident that in a few years the cost of wood will be in excess of that of coal.

Forseeing this situation, J. H. Williams, president and operating manager of the company, investigated the possibilities and merits of fuel oil for lime burning. Mr. Williams made a complete tour of the United States, visiting lime operations and calling on manufacturers of equipment. This trip, of course, afforded him an insight into many different methods of operation; but as oil burning in kilns at that time was a comparatively new process, the trip did not net him explicit knowledge on the subject. However, he did obtain considerable data on the general operation of lime plants, which he used in improving his plant.

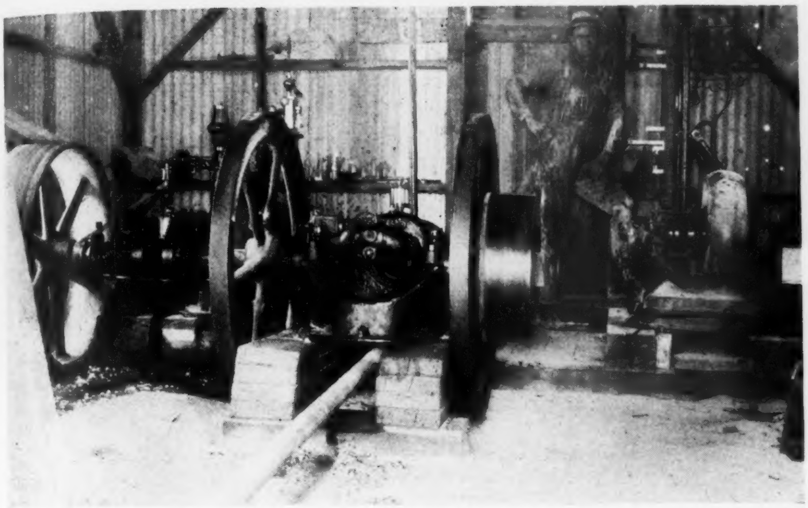
As Mr. Williams is a believer in the expression, "two heads are better than one," he set out to find a competent engineer who could offer constructive ideas as well as assist in carrying out those already formulated. His purpose was fulfilled when he obtained the services of T. E. Beebe, formerly of the firm, Beebe & Hobbs, Lakeside, Ohio. Mr. Beebe is well known in

At the left is shown how the construction of the new kilns is started; at the right, a completed kiln. The space between the casing and the kiln will be filled with rock-lime

This gives a good idea of what the material is like. The chutes from the trestle to the kilns are grizzlies of 1½-in. spacing

One end of the limeshed. The chute in the foreground at the right serves the crusher



This power station comprises a 9-hp. generator driven by a 10-hp. steam engine and a 10-hp. gas engine as an auxiliary unit

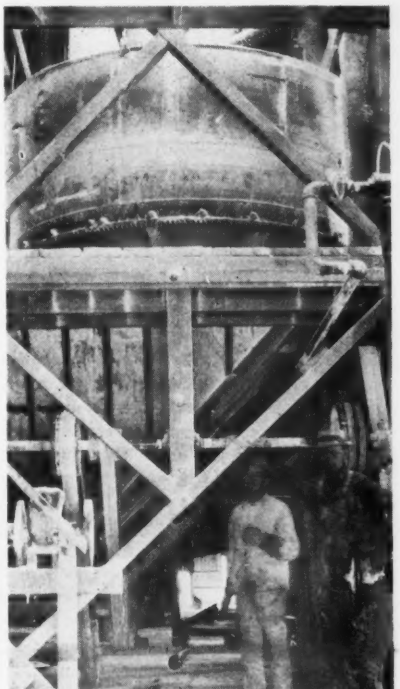
the lime industry in the East, having designed and rebuilt several operations in Ohio, Indiana, and states in that section.

Because of the softness of Florida stone, it cannot be burned in the type of kiln used for burning ordinary limestone, for in using kilns of average height, the rock would crumble in falling and consequently would choke the draft; therefore the average height of Florida kilns is from 14 to 20 ft.

The Commercial company has eight kilns, three of which were built for the original plant and are of stone construction, measuring 17 ft. square, outside. They are 5 ft. in diameter, inside measurement at the top, and are oblong at the bottom, measuring 6x6½ ft. at the eyes. The other five kilns are of the same design as the stone kilns, but are of brick construction. In building them, an attempt was made to reduce the amount of heat lost while sticking and knocking down, and also to increase the capacity by enlarging the inside proportions to a 6-ft. diameter at the top and 4x7½ ft. at the eyes, instead of 6x6½. Tests have shown that the new kilns produce four tons with the same amount of fuel that the old-style kilns produced 3½ tons. This kiln equipment gives the company a daily output of approximately 30 tons.

A greater output is necessary, however, to take care of the ever-increasing demand, and the company is building two additional kilns. These are being built even larger than the last ones constructed, and Mr. Beebe believes that the capacity of these kilns will be at least 25 per cent, and possibly 50 per cent, greater than those now in use. The new ones are of brick construction, measuring 16x17 ft. outside. Inside, they will be 7 ft. in diameter at the top and 4x8½ ft. at the eyes. These proportions, Mr. Beebe believes, will reduce the sticking and will permit drawing every 6 instead of every 12 hr. If the new kilns give the results that are expected, it is the plan to rebuild all of them so as to have a uniform battery.

The oil-burning experiments were made in the newer kilns, and the equipment chosen, which was used in the final tests, was a No. 1 Ray electric burner and pumping system. The tests were conducted on the basis of a production of 4 tons per 24 hr., using the same kiln and carefully weighing the amount of rock for each test. The results of the tests varied in accordance with the variations in draft caused by different weather conditions, but for the final summary, only averages of several accurate tests were used.



Hydrating plant and engine room. All machinery is driven from one main shaft

The average cost of producing four tons of lime with wood for fuel was $8.75 as compared with $5.997 with oil. The average wood test required 2½ cords at $3.50 a cord, and the average oil test showed a consumption of 168 gal. at 3.57 cents. In addition to the saving in fuel cost, the services of one man at $2 a day were eliminated in using oil, making a difference of $4.753, or a saving of 53 per cent, less 5 per cent as an overhead expense of the oil-burning equipment.

These tests were made with equipment lent by the manufacturer for that purpose, and the equipment was not installed permanently. When all of its kilns have been rebuilt, however, it is the company's plan to install a burner on each of them. The type of burner selected is atomized by air and has proved more satisfactory than others tried that were provided with steam atomization.

An aggressive trio. Left to right: J. H. Williams, president and general manager; W. M. Palmer, secretary and treasurer; and T. E. Beebe, engineer

The company has already installed oil-burning equipment on one of its boilers, having found that a saving in fuel costs equivalent to that effected in lime burning is possible. This equipment comprises a 9-hp. alternating-current generator driven by a 10-hp. Ajax steam engine. The generator provides current to a ½-hp. motor driving a No. 3 Ray oil pump which supplies the burner on the boiler. The supply of oil pumped to the burner, as well as the air, is controlled automatically by the throttle on the main engine. In addition to the steam engine which drives the generator, there is installed a 10-hp. Fairbanks-Morse gasoline engine that may be belt-connected to the generator and used for lighting purposes when the steam engine is not in use.

The only change necessary to the boilers in converting them from wood or coal to

oil burning, is to line the grates with fire-brick and mount the burner on the firebox door. The company has two boilers, only one of which is used at a time. Both have been lined so that the burner can be moved from one to the other.

While the lime plant as a whole is no different from the average plant found anywhere else, still it has several features that were designed to care for local conditions. One of the features is the crusher. This machine is a 24x24-in. roll crusher of local manufacture, and all the material from the kilns passes through it. Everything passing through the crusher is elevated in an enclosed chain-bucket elevator, fitted with 6x9-in. buckets, which discharges into a 30-in. by 8-ft. revolving screen of ½-in. perforations. Rejections from this screen are elevated to a 50-ton capacity steel-lined bin from which it is drawn and packed in barrels. The screen rejects approximately 50 per cent of the lime entering it. Material which passes through the ½-in. perforations is chuted into a 50-ton capacity tank mounted over a No. 3 Clyde hydrator.

The most excellent feature of the plant is its flexibility. The present method of operation results in 50 per cent of the total output of the kiln going to the hydrator and the other half into a bin from which it is drawn and barreled. If it is desired to change this proportion, and make more fines for the hydrator, a chute from the bulk-lime bin can be opened and the material allowed to run into a No. 0 Jeffrey hammer mill and thence to the hydrator; or, if it is desired to hydrate the entire output, it can be put through the smaller crusher direct from the kilns. If no material is wanted for the hydrator, the screen section may be removed and all of the material elevated to the bin for shipment in bulk.

The plant is equipped with a No. 0 Raymond mill and vacuum air separator. Here is also an unusual feature. The core or rejections from the Raymond mills is marketable and is removed by spiral conveyor into a bin from which it is drawn, and sacked and sold for agricultural purposes.

The hydrated lime is elevated and emptied into a 20-ton steel-lined bin mounted directly over a 4-spout Bates packer. The lime is sold under the trade name "Purock."

As the material is very soft, there is a great amount of fines made in the quarry that cannot be used in the kilns. This is loaded and taken to a No. 3 Jeffrey hammer mill and crushed to ⅛ in. and smaller. The material is received from the crusher by a 10-in. by 20-ft. belt-bucket elevator and loaded direct into railway cars. The plant produces about two cars of this material a week, which is sold as agricultural lime. The hammer mill and elevator are driven by a 55-hp. Erie engine. An even greater outlet for the fines than the agricultural market offers is that offered by the improved-roads movement. The material is used extensively throughout the states as a base for concrete and macadam roads and the company ships on an average of four cars a week. This material is shipped in a size 1 in. and smaller.

The Commercial company will give any producers interested in oil-burning installations any additional data that they may desire, and will also be glad to receive advice from any operator who can aid in better developing the operation.

In addition to its main offices at Ocala, the company maintains sales offices at Jacksonville under the direction of Virgil H. Lanier, sales manager. Mr. Lanier is a former secretary of the Soft Phosphate Association. The officers of the company, all of Ocala, are as follows: President, J. H. Williams; vice-president, Mrs. Mamie Hall, and secretary and treasurer, W. M. Palmer.

Magnesium Limestone Increases Tobacco Yield

MILLIONS of dollars can be saved to North Carolina farmers if they will use magnesia in some form to control the "sand drown" disease, says the *Progressive Farmer.*

What "sand drown" will do to the tobacco leaf is shown in this picture.—From literature of the American Limestone Co.

Experiments prove that this can be done comparatively inexpensively by the use of dolomitic limestone containing from 20 to 25 per cent magnesium carbonate. One thousand pounds to the acre in the drill was used in the tests at Oxford and gave excellent results.

Tobacco is being studied at both Reidsville and Oxford. The tests at Oxford on 36 different plots show that dolomitic limestone (magnesium limestone) has increased the yield of tobacco on all plots and that there is less leaf spot trouble where this form of lime is used than where not used.

The foregoing is taken from educational literature put out by the American Limestone Co., Knoxville, Tenn., accompanied by appropriate illustrations, in its desire to teach prospective users what can be accomplished with magnesium limestone. This company goes to great lengths in informing the farmer how he can benefit his crops by adopting better methods of farming and taking every means to enrich his soil. Anything of interest got out by agricultural colleges, experiment stations—all extension work of the federal government and the state institutions, in fact—are quickly made known to the farmer free of charge.

The educational work of the American company is commanding wide attention by the producers in the industry.

Who Can Beat This Record?

FOR this year, the average car loadings of the Menantico Sand and Gravel Co., Menantico, N. J., has been fifty-six and two-thirds tons. Hugh Haddow, Jr., a member of the National Association's executive committee, is responsible for this practical method of co-operating with the carriers.—*National Sand and Gravel Bulletin.*

Plaster from Limestone Dust!

Application of Colloid Chemistry to Rock Products Industries Holds Some Revolutionary Possibilities

By Cyrus Field Willard
San Diego, Calif.

SINCE my discovery that it is possible to do away with expensive lime kilns and costly hydrating plants and make a commercial plaster from raw unburned limestone (thus utilizing the waste of marble and limestone quarries), and the publication of my letter announcing such discovery in *Chemical and Metallurgical Engineering* of April 30, I have been the recipient of numerous letters from all parts of the United States asking how it was done and manifesting great interest in what has been considered heretofore as impossible.

None of these requests has given me greater pleasure than that of the editor of ROCK PRODUCTS, not only because in his letter he shows a comprehensive grasp of the whole situation but also because I feel that this paper more nearly reaches people I wish to benefit and to whom such a discovery as mine is as yet unknown. I refer more particularly to the manufacturers of lime who have heretofore found it necessary to keep up such expensive plants as I have referred to.

Because of the slowness of the United States Patent Office the decision on the application for a patent by myself and associate has been delayed and, while it is pending, it may not be advisable to go into the full details, much as I would like to do so. At one time it was not considered "good form" for those engaged in research to apply for a patent, but during the World War it was found that such an application often established priority better than by any other way.

While at the present time it may be inadvisable to give all the details, as I hope to do later on, to the readers of ROCK PRODUCTS, yet it may not be out of place to give some of the fundamentals which will allow those who are acquainted with the subject to fill in the gaps to supply the missing details.

What Is Colloidal Chemistry?

First it may be necessary for the layman to get a grasp on what is meant by colloid chemistry as he will hear more of it as the years go by, for it is the chemistry of industry.

We have gone a long distance since Graham divided matter into two classes, the crystalloids and the colloids. He suggested calling the starches, dextrin, the gums, the glues, albumin, tannin, gelatine, hydrous silicic acid, hydrous alumina, etc., colloids from the Greek word *kolle* for glue. His distinction between colloids and crystalloids has been dropped, since colloidal gold is certainly crystalline and we now speak of a colloidal state rather a colloidal substance.

As Prof. Wilder D. Bancroft in his little classic, "Applied Colloid Chemistry" (New York, 1921), has shown, we call any phase colloidal when it is sufficiently finely divided or dispersed without committing ourselves definitely as to what degree of subdivision is necessary in any particular case. He further says: "Adopting the very flexible definition that a phase is called colloidal when it is sufficiently finely divided, colloid chemistry is the chemistry of bubbles, drops, grains, filaments and films, because in each of these cases at least one dimension of the phase is very small."

What drew forth my letter in *Chemical and Metallurgical Engineering* was the lament, in an issue a few weeks previous, by Oliver Bowles, mineral technologist of the Bureau of Mines, that so little was known about lime, and what a promising field of research it was, and he wound up with the request, "Who will supplement our present meager information?" Coming, as it did, after the termination of a series of very successful experiments on lime in a colloidal state, I could not forbear giving out just a little of the information I had gleaned.

There seems to be so little known about the world of little things! The microscopist sees it, to some extent, but takes but little part in its activities. What thoughts arise as we think of these matters and what a vast field for research does indeed lie open before us. Why are some solids soluble while others are not? When solids are reduced to a finely comminuted state, Bancroft shows that they act like liquids, some being absorbed by others—which fact I have taken advantage of. A solution of gelatine will "jell" when it cools, yet lime is dissolved better when it is cool than when the water is hot. Will any finely comminuted solid act as a "jellifying" substance when heated and then cooled? Why do snowflakes aggregate into icebergs and destroy "Titanics"? What makes the aggregating force of cement and hydrated lime when mixed with water? Is there a rising of temperature and a lowering thereafter, with a succeeding "jelling" effect? What causes "chemical affinity" so-called? These and many other questions presented themselves to me in my investigations.

Origin of Limestone

Geologists tell us that at once time the ocean was a solution of calcium chloride and some of this still remains in small quantities in the water of the ocean. The water of the rivers, emptying into that ocean, was heavily charged with carbonate of soda which it drew from the water trickling over ancient beds of soluble soda-feldspar. When this water came in contact with the water of the ocean there was an interchange of elements, the sodium of the sodium carbonate united with the chlorine of the calcium chloride to form sodium chloride (common salt) which still remains in solution as the principal constituent of sea water.

The calcium released from the chlorine probably disintegrated the water, as did no

EDITOR'S NOTE

ROCK PRODUCTS prints this article contrary to the advice of perhaps the best-informed man in the United States on the subject of lime chemistry.

We appreciate the dangers of "going off half-cocked"—of the article being taken more seriously than perhaps the facts and the present status of the subject justify. On the other hand, with some acquaintance of the subject of colloid chemistry as already applied in the rock products and other industries, we do feel that it would be neglecting our duty not to keep the lime and limestone industries informed of the progress being made and of the possibilities being opened in this most interesting and newest field of scientific research.

With this in mind, and with the assurance that Mr. Willard will follow this article with others explaining in more detail the applications of colloid chemistry to the rock products field, we asked him to write this article, and we are willing to run the possible risk of being misunderstood in the presentation of the subject.—N. C. R.

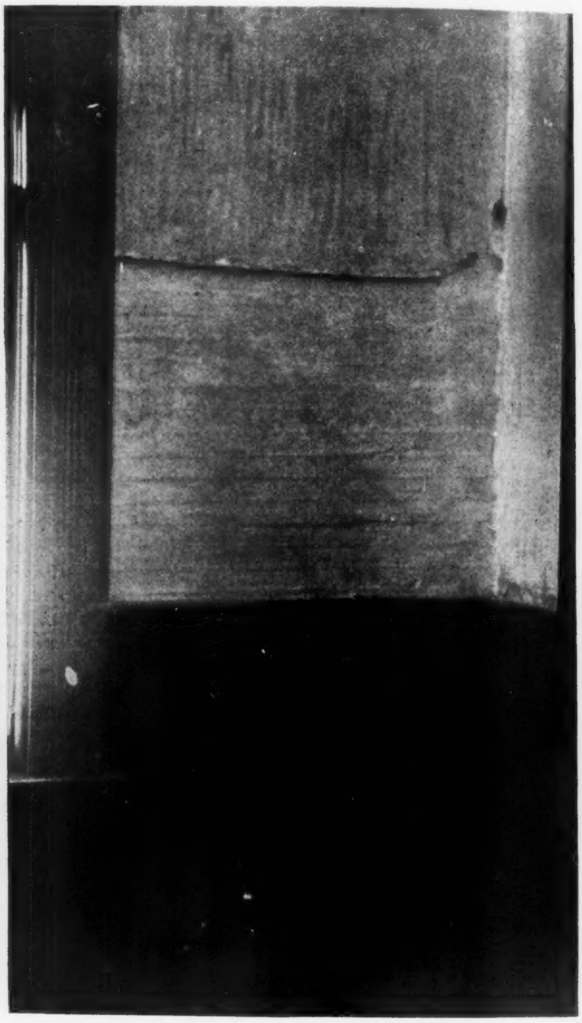
doubt some of the sodium, and took up some of the oxygen dissociated from the water (H_2O), when it united with the carbonate radical, after more or less complicated chemical action and reaction, to form calcium carbonate ($CaCo_3$).

This calcium carbonate was then a suspensoid and it was later deposited by sedimentation on the floor of the then ocean, carrying down with it entrained traces of organic matter of a vegetable or animal nature, which sedimentation may have been assisted by aluminum hydroxide formed by the hydroxyl radical resulting from the dissociation and recombining of hydrogen and oxygen with the alumina of the fluvial waters, just as impure water is now purified by aluminum hydroxide.

Whatever may have been the chemical means, we know that huge masses of limestone were formed by sedimentation, some of which was heated, crystallized and cooled again as marble, without driving off the carbon dioxide.

The question arises, What were the "collifying" (if I may coin a word in the original sense of the word *kolle*, meaning *glue*) influences that brought about the formation of this fine sediment of calcium carbonate into a stone? While it has been laid to heat and pressure after the limestone was covered by other sediments, yet another solution is possible. This was discovered as an answer to the following question:

Plaster outside in rain since February 14. Photograph was taken May 19, 1923



On the 16th of February the rough coat shown here was applied to the lath surface

"Is it not possible, by finely comminuting his limestone so as to bring it back to its original state somewhat resembling fine particles of sediment and then adding different organic and inorganic substances, also finely comminuted, and mixing them together in water as limestone was formed—to form a paste which will make a firm, hard, solid, homogeneous substance when the water has been dried out or driven off?"

By thus following in the processes of Nature I made the discovery, assisted by my associate, that it could be so done. After many experiments, during which all kinds of materials were used, I found that it was a new process which had been discovered, one which does away with the necessity of burning in expensive lime kilns the $CaCO_3$ to form CaO and, by hydration, forming $Ca(OH)_2$ or hydrated lime which, when mixed with water, sand, etc., and applied as plaster on the walls, gives up its water and gradually absorbs CO_2 from the atmosphere to restore the lime back to its original state as $CaCO_3$. Why go through this cycle when it is not necessary?

Origin of Lime

Our forefathers discovered that by burning the limestone of the neighboring hills in their crude fires and pouring water on the hissing mass, with its included sand, a paste or plaster was formed which dried hard when applied to their wattle huts. Charles Lamb tells how the Chinese discovered the deliciousness of roast pork by the accidenta

burning of an outbuilding where pigs were confined and the burning of the fingers of the man who put his hand on the roast pig then put his fingers to his mouth to allay the pain.

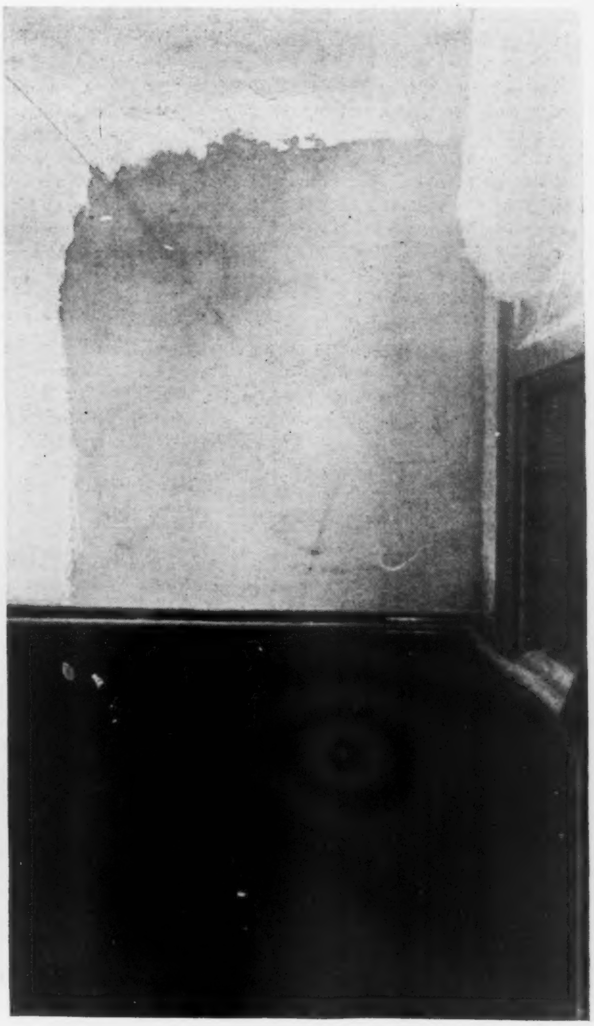
We do not need to burn down the house to roast the pig, any more than we need to calcine lime when the same effect, or better, can be produced with finely powdered unburned limestone, where over 95 per cent is lime and the collifying matter added is so now sold and from which it is impossible to tell it by looks, except that our product is a little finer.

When mixed with water as hydrated lime is now mixed it makes a hard-finish lime out of the cheapest lime now on the market that we have been able to find here on the Pacific Coast.

Out here we have taken hydrated lime that was too "short" to be used for finish-lime and only good for land lime, and made ter wall has been considered as one of the lost arts of the ancients.

The lime in the present-day hydrated lime, which is necessarily slightly caustic, since its "affinity" for water has not been altogether satisfied, seems to destroy the pigmentation power of the usual pigments (and unusual as well), leaving the wall spotted, and so the idea of obtaining a solid-color plaster wall has been abandoned about as often as it has been tried, and the wall

Panel of light blue solid plaster, applied February 21, 1923, over old plaster



Yellow, solid color plaster, applied February 21, 1923, over old plaster

cheap and so little is used that with a ton of ground unburned lime the added cost will not exceed a fraction of the cost of a ton of lime!

Plastic Limestone!

A grinding plant is all that is necessary and the collifying substance or substances (and I have covered everything that could be thought of in experimentation) are solids which may be ground to the same fineness and at the same time as the lime, and then put up in similar bags, as hydrated lime is a finishing lime that was as plastic as the best finishing lime.

Solid Color Plaster

One peculiar feature of our work has been the production of a solid-color plaster wall of different colors where the pigment was mixed cold with the ground raw lime. We produced a blue plaster wall which was blue all the way through and which reminds one of the light blue plaster walls in some of the old temples of Egypt, which have stood for many centuries and which solid colored plaster wall has been considered as one of the lost arts of the ancients. painted over to cover the "patchy" appearance of the wall.

We have walls made of uncolored (as well as solid color) plaster which has been on the wall for periods ranging from two to four months and the only change that can be noticed is that it appears to be getting harder, which is as it should be if my theories are correct.

It can be polished with an agate burnisher so that it takes a smooth surface like polished marble. A curious fact about the polished surface is that it appears to be water-

proof as the water runs off, without being absorbed.

This lime aggregate adheres to smooth-planed wood surfaces and to oily corrugated paper and cardboard sheets (such as are used for packing glass bottles) and can be used with paper, to which it strongly adheres, to make a wall board, which we have done.

As a Stucco Material

We have applied this lime plaster to rough 1x12 up-and-down boards on the outside of a building and it has remained there during all the torrential rains of the rainy season of California (and it makes a business of it here when it does rain), and while it softens a little, yet it dries out each time harder than it was before. This process is going to extend the use of lime in many directions, especially in the so-called California houses where no laths are used. It does not seem to require the "key" or "clinch" that the usual lime must have with laths and all the plasterers who have used it appear to be well pleased with it since it makes their work easier. It does not set quickly, so that a plasterer can put on a coat of this plaster, go and eat his dinner and come back in an hour or two later and go on working it again. In this it is entirely different from the usual finish lime and that one fact alone would give it the preference over any finish lime on the market, and it gets harder than any of them when it does make up its mind to dry.

There seems to be a large field for its use in casting in molds, for center-pieces, etc., but this is a matter which we cannot speak about with certainty yet, as we have not tried it out as exhaustively as we have in the other cases mentioned.

One peculiar fact noticed is that the raw lime treated by our process adheres to metal better than the ordinary lime and we have plastered over nails and nailheads (without puttying) without the slightest trouble and their presence could not be discerned.

Another severe test we gave it was to plaster over old and smooth-surfaced plaster walls and it adhered perfectly. Any plasterer will recognize this as a most severe and satisfactory test.

We plastered several walls partially, some over old plaster, to show how it could be applied, and discarded samples, knowing that the average man would say when samples were shown him: "Yes, that is all right for a sample, but what I want to see is a practical test with the plaster put on the wall and find out how it is going to wear there."

Extensive Experiments Under Way

Experience has shown that this view was the correct one. A member of one of the largest corporations in the country has been to San Diego to see these samples on the wall and is arranging to make the most searching tests which, if satisfactory, will lead to the making of definite arrangements to take over the whole process.

I make this latter statement so that you readers may know that there is nothing to sell, but, on the contrary, it is my idea that every lime manufacturer in the country shall have the right to use the process by the payment of a small royalty, which even then would be much less than his lime is now costing him. Otherwise, I would hold on to the patents.

It is my idea that, when the whole lime industry has the right to use the process by the payment of a small royalty, the cost of building will be materially decreased. This will be still further decreased by an improved system of roofing, using colloidal lime, and which does away with the use of tar paper, on which the application for a patent has been pronounced allowable by the examiner. In addition to this, I have had issued to me three patents for producing a product from waste, which is almost thrown away today, and by means of which flooring and siding, using large amounts of inert substances such as fine ground lime, can be made at a very low figure.

"For the Benefit of Humanity"

Back of all this is the realization on my part that the demand for a higher standard of living for "Mr. Common People" is based on justice. If the housing of the common people can be lifted to a higher plane while decreasing its cost through my inventions and discoveries, then I will feel that I have not lived in vain and the satisfaction that will flow therefrom will be greater than any monetary rewards, great as they may be. I would rather have the knowledge that I had been of some benefit to the human race by my living, than to have a lot of money which I must leave behind.

There is no doubt in my mind that Henry Ford feels more satisfaction in the fact that he has been able to pay $6 a day to his workmen, thus giving them more of the comforts of life, than he does in seeing $10,000,000 more added to his already swollen stock of cash.

There is going to come soon a rearrangement of cities. The flivver airplane, the automatic stabilizer and the odic ray, all of which have filled the newspapers recently, are going to make new homes and new cities in sweet, open places, far from stinking wharves and noisy railway terminals.

Here new houses and buildings of inexpensive lime; ceilings, floors and roofs, with siding composed of lime and other compounds, attached to studding of similar material, and forming a truly fireproof construction, will be erected amid beautiful surroundings giving the lime industry such a boom as it never had before. Each waterproof roof will have its own flivver airplane landing.

Things are now moving rapidly, physically and mentally. There is no phrase so old-fashioned as "It can't be done."

In a very short time, now, the old Missourians will be shown, and I expect to tell you more about it in a very short time.

In conclusion, let me say that if anyone has any doubts that I have done as I have described above, let them come or send someone, here and I shall be pleased to show them the plaster on the walls where it has been for the past five months.

If they will bring their ground limestone, as did the representative of one of the largest companies in the country only this week, with his limestone ground 100 per cent to 100 mesh, we shall be pleased to turn it into hard-finish lime plaster before their eyes, strange as it may seem. This gentleman was a "doubting Thomas" if there ever was one, but after he had stood over the mixing and applied the mortar, wielding the trowel himself, he said: "A man is a fool to say that anything cannot be done nowadays."

Sawyer Appointed Secretary of A. G. C.

COLONEL D. H. SAWYER has been appointed secretary of the Associated General Contractors of America to fill the place of Eugene Young, who recently resigned to enter business in Minneapolis.

Colonel Sawyer was graduated in engineering from the University of Illinois and is a member of the American Society of Engineers. Going East, he was engaged in engineering and building operations for about a year when he returned to Illinois, becoming city engineer of Paris.

In 1908 Colonel Sawyer joined his brothers in the Northwest, forming the firm of Sawyer Bros., who, with offices in Seattle and Spokane, engaged in consulting and designing engineering work.

Summoned to Washington in May, 1917, he was soon commissioned a major in the Quartermaster Corps and assigned as construction quartermaster to build the original Camp Grant. Upon the completion of this assignment he was engaged in building a nitrate plant near Cincinnati, Camp Bragg, and in a supervisory capacity was in charge of construction of quartermaster storage projects throughout the East and Central West. Following his resignation from the service, he became associated with the James Stewart Co.

He brings to his new position years of experience in the engineering and construction field which peculiarly fits him for the secretaryship of the A. G. C.

To Mine Asphalt Rock in Missouri

ACCORDING to information received from Sheldon, Mo., the National Asphalt Refining Co. is to begin at an early date the mining of asphalt rock at Richards, Mo., which is located about 50 miles south of Kansas City in Vernon county.

To mine the 46-ft. deposit of rock it will be necessary to go down to a depth of 170 ft. Preparations for the sinking of a shaft have been made and a reservoir for a water supply has already been completed.

The Louisville Cement Company's New "Brixment" Plant

Beginning the Production of this Patented Product with Its Original Natural Cement Plant, the Company has Gradually Added Equipment and Buildings until it now Operates a Distinctive Type Modern Plant with a Daily Capacity of 3500 Barrels

THE PROCESS of manufacturing "Brixment" was patented on December 2, 1919, by H. D. Baylor, general superintendent of the Louisville Cement Co., Speed, Ind., and its manufacture and sale have been continued on a constantly increasing scale.

The 22 kilns in this row and 6 in another row in the rear make up the battery for burning Brixment. At the right background, the crushing plant; at the left, the incline from the kilns to the Brixment plant

Brixment is a plastic, slow-setting, hydraulic cement for masonry; its manufacturers claim it to be especially adapted for use in dampness, as it sets either in air or water. It is a ready-prepared mortar cement requiring no soaking or preliminary preparation other than mixing, and is a mixture containing 81 per cent natural cement, 10 per cent quicklime, 1½ per cent wax distillate, and 7½ per cent water. Complete details of the original process may be found on pages 17 to 22 of the April 10, 1920, issue of Rock Products.

The Quarry

The quarry at this operation is one of the largest, most economically and efficiently operated in the country. Including the stripping operation, it is worked on four levels. The two lower levels, each having a 20-ft. face, contain a high calcium stone used in making portland cement. From these levels the company also obtains its stone for manufacturing the quicklime used in the manufacture of Brixment. The upper level has a 14-ft. face, and it is from this stratum that 81 per cent of the Brixment mixture is obtained. It is a limestone of clayey composition, or technically, an argillaceous magnesium limestone. Analysis of a sample from this layer is as follows: $MgCO_3$, 19.70; $CaCO_3$, 59.00; SiO_2, 14.07, and iron and alumina, 7.27. An average of several analyses of samples from the lower levels shows: $MgCO_3$, 3.0; $CaCO_3$, 92.5; SiO_2, 2.5, and iron and alumina, 1.5.

This 14-ft. deposit of stone underlies 6 to 8 ft. of clay overburden which is stripped by steam shovel and removed by locomotive and cars. This overburden is used in the manufacture of portland cement. By working the quarry on four levels an economical method of quarry transportation is afforded. As the cement and Brixment plants are more than a mile from the quarry, there is but one track connecting the two points and one heavy-duty locomotive is used to move

Drilling and stripping the low-calcium deposit used in the manufacture of Brixment

Loading Brixment stone in 6-yd. dump cars. This 14-ft. deposit would otherwise be a waste, as it is inferior for making portland cement

Here it is crushed to a size suitable for the kilns. The material in the dump car is spalls, taken out by a 3-in. grizzly when crushing high-calcium stone

all the material. On the upper level of the quarry are railway yards where cars from each of the three levels are placed by engines from each level. Thus, the quarry operation is continuous and a surplus of both grades of stone is always available at both the plants and the quarry.

The crusher discharges direct into 3-ton, special-design steel cars

How coal is applied. By turning the crank, a curved section of 8-in. pipe in the bottom is revolved so that the coal is sprinkled evenly

As nearly as it has been possible to do so, the company has standardized its quarry equipment. Motive equipment comprises six Porter steam locomotives ranging in size from 12 to 18 tons, and 6-yd. Continental one-way dump cars. Loading of stone on each level is done by Marion Model 60 steam shovels, while the stripping is handled by a 40-ton Vulcan. Drilling is done with three Ingersoll-Rand wagon drills and one Sanderson "Cyclone" well drill.

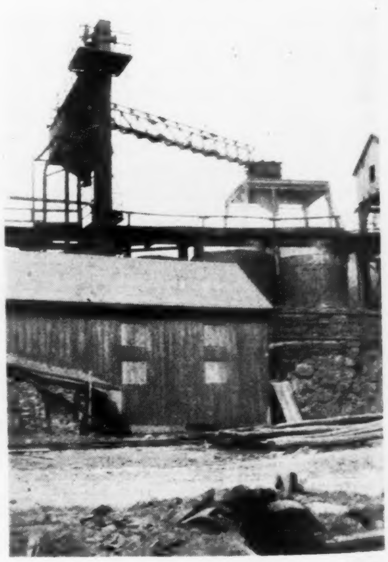
A particular feature of the quarry is its excellent trackage. Although it is narrow-gage, the roadbed and track construction between the quarry and plant are of such excellence that a speed of 25 to 30 miles per hour is attained. This permits the hauling with one locomotive of the same amount of material hauled a like distance over an average quarry track by two locomotives.

The Crushing Plant

The crushing unit of the Brixment plant is at present in a state of reconstruction. This plant, which was the primary unit in the old natural cement plant, was built in Civil War days, and, with occasional new timbers, has given continual good service. The crusher — an 18x30-in. Blake jaw — is one of the first built and is being removed not because of inefficiency but because an increased output is necessary. The new crusher is a 36x48-in. Traylor jaw and is now being installed. This machine will be set to discharge at 8 in. and will be driven by a 125-hp. motor.

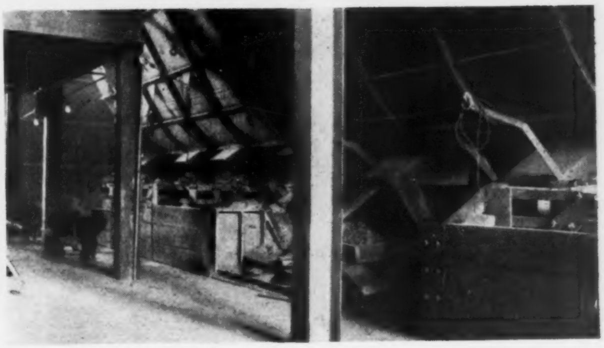
When the natural-cement rock for Brixment is being crushed, the crusher, set at 8 in., discharges direct into 3-yd. steel cars which are pulled up an incline to the kilns. In this crusher is also crushed the high calcium stone which is burned in two special kilns and is used in the amount of 10 per cent in the Brixment mixture. When crushing this stone, a steel plate, which serves as a cover for a 3-in. bar grizzly, can be taken up so that spalls will pass through. Material passing through the grizzly is chuted

Cars from either of the two tracks under the crusher may be taken to either row of kilns. The switches are controlled from the bottom



These coal bins over the two rows of kilns hold 20 tons each. The elevator is fed from a track hopper

When a car is loaded it is moved by gravity under the steel tank where quicklime is added

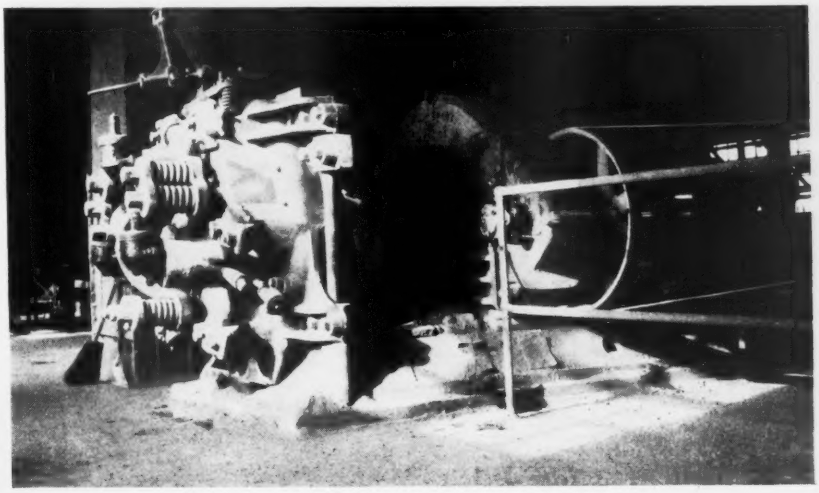


This steel bunker holds 1500 bbl. of raw material. From here the raw material is chuted to pot crushers by gravity

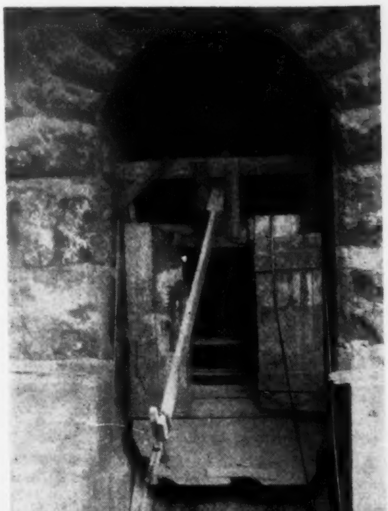
to a bucket elevator which empties into a 6-yd. dump car. As there is very little of this size material, this method of taking care of it is the most economical, as it can be hauled away, transferred to wagons or trucks and used in improving roadways, walks, etc., about the plant.

Cars are pulled up the incline one at a time by an electric hoist and the incline is arranged so that cars from either of the two tracks under the crusher may be taken to the top of either of two rows of kilns. This is effected by a switch midway of the incline controlled from the bottom by rods.

The battery of kilns is comprised of two parallel rows, one having 6, the other 22 kilns. The greater number of the kilns were also part of the original natural cement plant, and those that have been added to the original number are similar in design. All are provided with steel casings. They are 10 ft. inside diameter at the top, tapering to 6 ft. at the bottom. The kilns in the main line are 35 ft. high, with the exception of those at the incline, which taper in proportion to the incline. The last two kilns in the main line are used exclusively for burning high-calcium stone, the entire output of which is used in making Brixment.



After the material is crushed it is screened on an 8-mesh woven wire screen. The rejections are crushed in this ring-roll crusher



A "close-up" of one of the kilns showing the apron-type, lever-controlled gate

Method of Firing

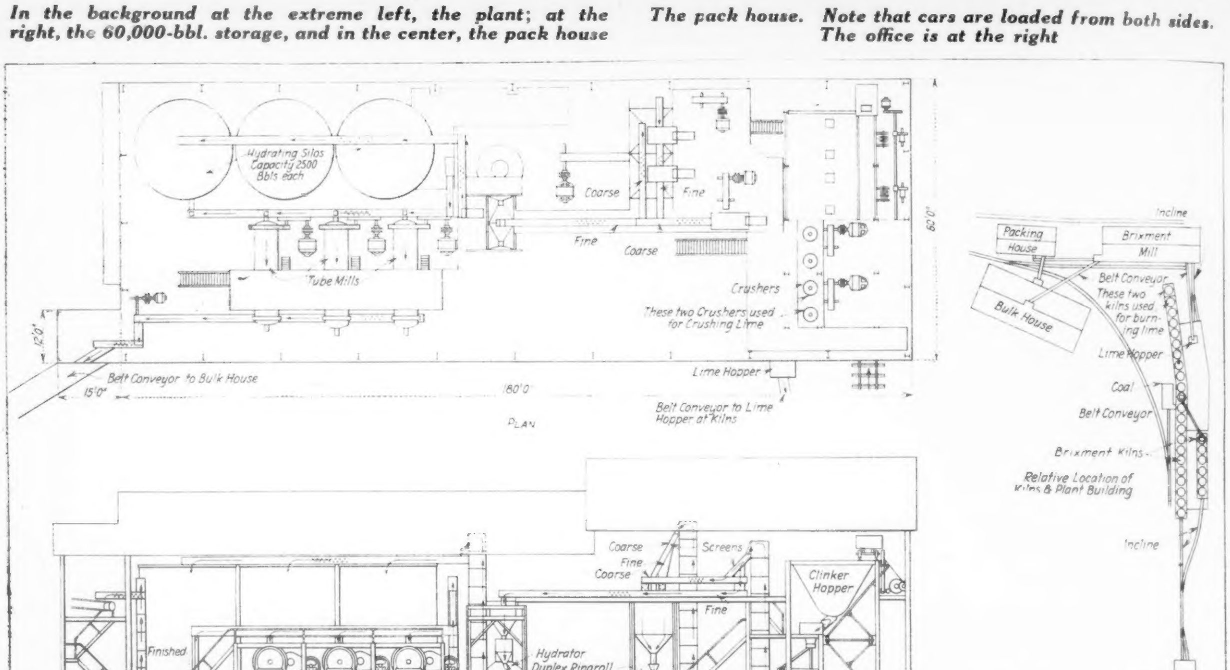
The method of firing is practically the same as that employed at ordinary internally-fired kiln operations. Alternate layers of coal and stone are made with no handling of either product by hand. The stone is dumped direct, while the coal is applied through the use of a hopper-bottom car with a revolving chute which affords an even distribution. One of the illustrations shows this apparatus in use. A 45-deg. section of 8-in. steel pipe has been fitted in the bottom of the car in such a way that by turning a crank on the outside of the car the section of pipe revolves, spreading the coal with the same effect as by spreading it by hand with a shovel, but more evenly. Actual coal consumption is 40 lb. per finished barrel of Brixment.

One of the illustrations also shows how the coal is put to the top of the tipple. An unloading hopper for railroad cars is located midway of the main line of kilns. An enclosed bucket elevator from this hopper

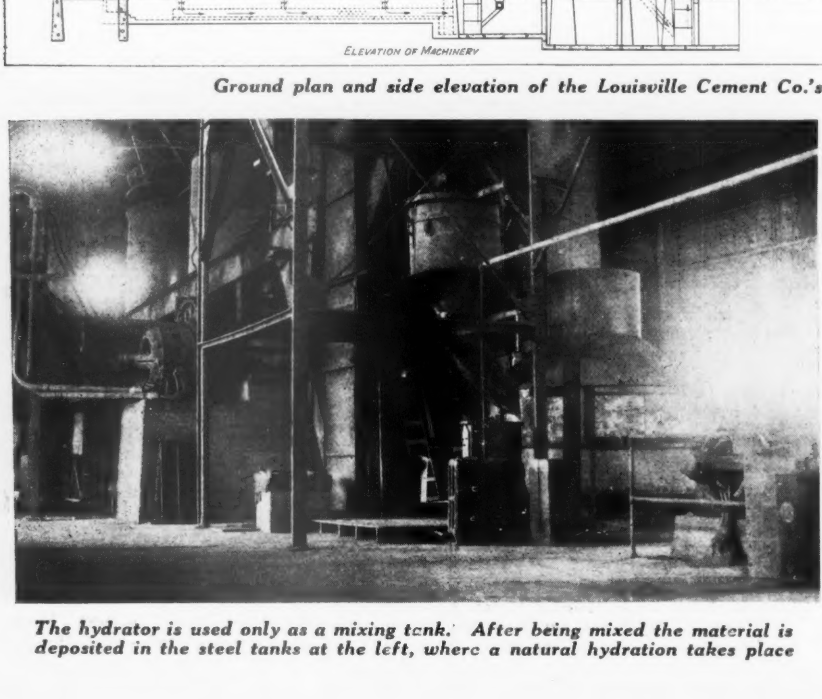
A carload of "mix" en route to the plant

In the background at the extreme left, the plant; at the right, the 60,000-bbl. storage, and in the center, the pack house

The pack house. Note that cars are loaded from both sides. The office is at the right



Ground plan and side elevation of the Louisville Cement Co.'s new Brixment plant



The hydrator is used only as a mixing tank. After being mixed the material is deposited in the steel tanks at the left, where a natural hydration takes place

empties in a 20-ton steel bin mounted over the main line and from this bin the coal is loaded into the distributing car. A conveyor, mounted on a structural steel bridge, extends from the discharge point of the elevator to a bin of similar construction mounted over the second row of kilns.

The alley between the two rows of kilns provides for two tracks—one along the side of each row, as the kilns are drawn from one side only. Each eye is fitted with a hinged apron-type gate controlled by a lever, which permits loading directly into 3-yd. cars.

High-calcium lime, burned in the last two kilns, is drawn in the same manner, taken up the incline and put through a pot-type crusher which reduces it to 1 in. and smaller. From the crusher it is conveyed over a 16-in. belt of 150-ft. centers and discharged into a 100-ton capacity steel tank which is suspended from an overhead struc-

tural steel bridge which also supports the conveyor.

When a car of natural cement, or Brixment lime, is loaded, it is moved by gravity under the bin containing the quicklime. Here

Installing the new 36x48-in. jaw crusher. It will be set to discharge at 7 in. and will be driven by a 125-hp. motor

360 lb. of lime are added, making the total contents 6000 lb., or the ingredients for 20 bbl. of finished product.

When loaded the cars are pulled back by a small hoist and switched to the main incline, up which they are pulled one at a time by a single-drum Lidgerwood hoist powered by a 75-hp. motor. The top of the incline is within the Brixment plant proper and is provided with a steel, V-shaped bunker of 1500-bbl. capacity.

Method of Manufacturing

This mixture of the two grades of lime is drawn from the bunker through four gates and chuted direct to four pot-type crushers (of the company's own design) which reduce it to ½ in. and smaller. The product of the crushers moves by gravity to a chain-bucket elevator of 35-ft. centers, fitted with 7x16-in. buckets, enclosed in a 2x4-ft. steel casing. The elevator discharges on a flat woven-wire 8-mesh screen, which is inclined at 35 deg.

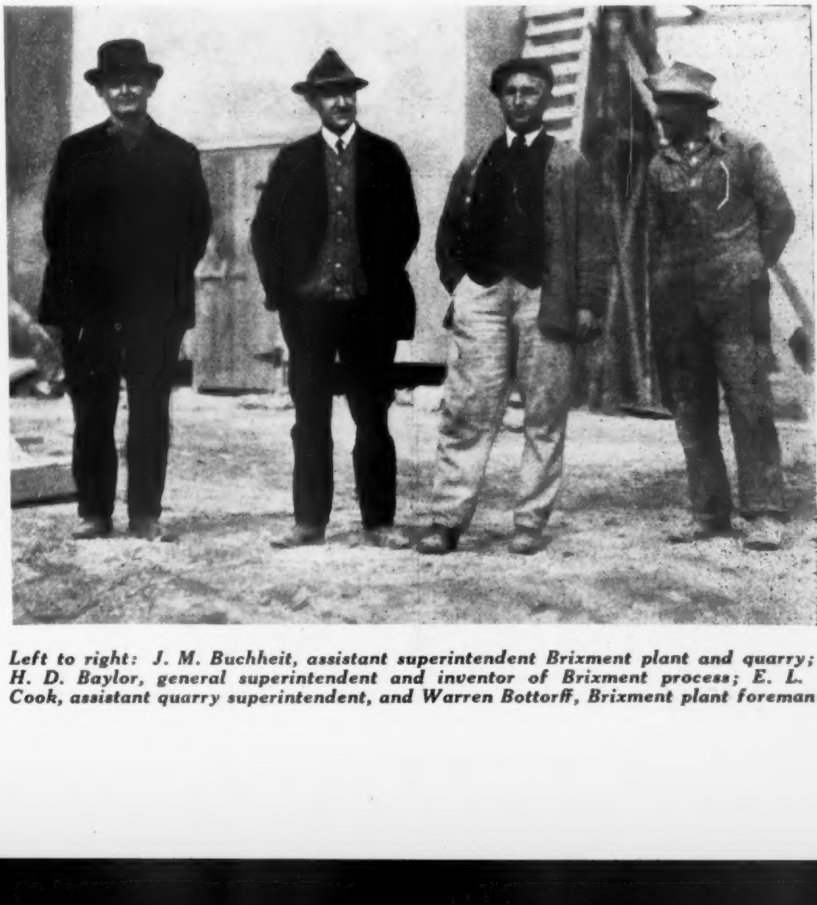
Material retained by this screen is conveyed by a spiral conveyor to a 600-bbl. capacity steel hopper over a No. 2 Sturtevant duplex ring-roll crusher which reduces it so that 60 per cent will pass through a 100-mesh screen. From here it is moved, along with the product of the 8-mesh screen, by spiral conveyor to a steel hopper mounted over a Clyde lime hydrator.

The hydrator here is not used for complete hydration purposes. It serves only as a mixing tank and is equipped with a home-made measuring tank for adding the proper amount of wax distillate. The mix in the hydrator is composed of 92 parts of the aforemention lime mixture, 1½ parts wax distillate, and 6½ parts water. These ingredients remain in the hydrator only long enough to become thoroughly incorporated. Mixes are made in one-ton batches.

When a batch is mixed it is discharged and elevated (in an elevator similar to the one handling the product of the crushers), emptying into one of three cylindrical steel tanks of 2500-bbl. capacity each. These tanks are filled alternately, the practice being to draw from the one first filled. The material remains in the tanks not less than 24 to 48 hr., according to atmospheric conditions. This, the manufacturers claim, affords a natural hydration, the tanks being fitted with vent pipes to carry off excess moisture. Here also the quick-setting elements of the cement are eliminated. The wax, which is added to give the product plasticity and to delay the setting, becomes completely and uniformly distributed during this natural hydration, due to the heat's tendency to increase its fluidity.

The material is removed from the tanks by spiral conveyors underneath which empty into an elevator; this, in turn, discharges into a second screw conveyor which feeds into two 5½x22-ft. and one 5x22-ft. tube mills. Here the slaked mixture is ground to a fineness such that 98 per cent will pass through a 100-mesh screen.

From the tube mills the finished Brixment is conveyed by a 22-in. belt conveyor of 220-ft. centers, provided with a housing, to storage in an adjoining building. This building is of steel and concrete construction and is divided into two bins, each of 30,000-bbl. capacity. Removal from storage



Left to right: J. M. Buchheit, assistant superintendent Brixment plant and quarry; H. D. Baylor, general superintendent and inventor of Brixment process; E. L. Cook, assistant quarry superintendent, and Warren Bottorff, Brixment plant foreman

is effected by a 14-in. conveyor, extending the full width of the building between the bins, which is fed by five screw conveyors from each bin. These conveyors are spaced 15 ft. apart, so that if necessary the bins can be completely drained of their contents. The main conveyor empties into the boot of a 16-in. bucket elevator which deposits the product on a 24-in. conveyor of 80-ft. centers leading to the packing house.

Brixment is not stored in bags, but is packed in accordance with orders on hand. At present the company is equipped to bag and load 2400 bbl. per 8-hr. day, but upon the completion of the installation of a third four-spout packer similar to those now in use, it expects to have an average daily output of 3500 bbl.

The Gypsum Industry From a Quality Man's Viewpoint

II—The Cummer or Rotary Process of Calcination—Comparison With Kettle Process

THIS process is not employed at more than six plants throughout the United States, but it has been found so economical and successful that two new plants recently constructed in New York state have been designed to calcine by this method.

The calcination is a continuous operation accomplished by a cylindrical rotating steel kiln practically the same as the rotary kilns employed at cement plants. These calciners now in operation in the gypsum industry are from 85 to 110 ft. long and about 6 ft. in diameter and rotate slowly with the discharge end slightly lower than the feed end. They are lined with one thickness of brick to withstand the heat and in some cases are covered with an iron shell to reduce radiation. Metal steps may be bolted along the inside in screw-shaped form to propel the flow of rock, but these steps have not been found necessary if the pitch of the calciner is made at least ½ in. to the foot. They are heated by direct fire supplied in most cases by pulverized coal automatically fed. A motor-driven fan connected with the flue outlet supplies the draft and collects the dust which is deposited into a dust bin.

The temperature of the rock stream is recorded by a recording thermometer as it passes over the thermometer bulb placed in the discharge spout. To check the uniformity of the heat temperatures it is also beneficial to have recorded the temperatures of the flue gas.

The rock stream, which has been reduced by jaw and lastly a swing-hammer crusher to a maximum ¾-in. size, is automatically fed from an overhead storage bin into the upper end of the calciner. A feeder of the reciprocating type is usually used.

In some plants the pitch of the calciner and consequently the direction of the flow of rock is toward the firebox, while in others the flow of rock is propelled from the firebox.

The stream passes through the calciner in approximately 45 to 50 min. and the temperature of the rock at the discharge end is kept at about 350 to 400 deg. Fahr. if the flow is from the firebox, and from 425 to 500 deg. Fahr. if the flow of the rock is toward the firebox. Manufacturers attempt to keep the temperature within a range of 10 or 15 deg. however, and the temperatures given above show approximate desired temperatures that different manufacturers have adopted for calcination.

The temperature required for calcination has been found to be influenced by the draft, the time of calcination, the size of the feed, the volume of the feed, and the quality of the rock.

Also, it appears that manufacturers widely disagree upon the proper point or degree to which gypsum should be calcined. All those conditions make it impossible to decide upon a certain time or definite temperature of calcination, and it appears this can be found out only by experimentation in order to satisfy the desire to make a product of a certain quality. It seems unfortunate that "calcined gypsum" has not been standardized in quality more than it has. The average capacity of one of the rotary calciners is 25 tons of calcined rock per hour.

The discharge spout is provided with a swinging gate so that when starting up the calciner or at any time that the temperatures appear to be dangerously high or low, the stream can be converted into a screw conveyor and elevated back into the rock bin to be recalcined.

The original intention of the Cummer process was to convey the output of the hot calcined rock into brick-lined storage bins for several hours, and let the heat disseminate through the mass of rock and calcine whatever oversize uncalcined lumps might be present. However, this practice has been discontinued because of limited storage room and the desire to speed up production, and the calcined rock is not kept in bins any longer than is necessary before being fed to the grinders.

The product after being fed to the grinders, which are usually either burr-stones or Raymond mills, is then ground so that about 90 to 95 per cent will pass through a 100-mesh sieve to meet the demand of the Eastern trade. It now attains the commercial name of "calcined gypsum."

The physical properties of gypsum calcined by this rotary method are widely different from the properties of either first or second settle calcined gypsum, the products of the kettle process, though manufactured from the same rock and ground to the same final fineness. These comparative properties will be discussed later.

The Rotary Method Will Probably Replace the Kettles in Time

While the rotary calciner is referred to as a more modern method and proven more economical from a fuel and operating standpoint, manufacturers have not as yet mastered the control of making as uniform a product by this method as is obtained at the present time by kettles. It is believed, however, that this is because not enough attention has been paid to the matter of quality and it appears from the experience of operators that the first step necessary in order to maintain more uniform temperatures and a more uniform product, is to furnish a more uniform size of feed by eliminating as much as possible of the fines and the oversize. This can be done by suitable screens; the rejects will not be wasted, but can be shipped to the portland cement trade where gypsum is used for regulating the settling time of cement, or can be ground finer for agricultural uses or to be calcined in a kettle. Some of the modern mills today employ both the rotary calciners and the kettles, using the kettles mainly for manufacturing second settle plaster, which is denser and stronger and more suitable for the plate-glass trade and for casting roof tile.

Although the kettle method appears to be the only present method by which gypsum can be calcined into as dense and strong a product as second settle, it is believed that this product can be duplicated by a modification of the rotary method and that rotary calciners will replace kettles just as soon as the problem now confronting operators are worked out, and they will be worked out as

soon as the operators are willing to spend the time and the money to do it.

The rotary process should make the most uniform product because of its simplicity compared with the kettle process by which the product is calcined in batches as previously explained, and several conditions prevail in kettle mills which will affect the uniformity if not watched closely.

One of the most serious obstacles which kettle operators often have to contend with are leaky kettle gates, which at times allow some of the fine raw gypsum to escape into the hot pits and bins, and a very small amount of uncalcined or raw gypsum will contaminate several tons of the calcined product.

Tests show that the addition of 1 per cent by weight of raw gypsum will accelerate the settling time of calcined gypsum so that it will set in practically one-half the time normally required—also even small percentages of raw gypsum noticeably weaken the strength of the calcined product.

While in this article of ROCK PRODUCTS, June 16, it was stated that calcined gypsum at various deposits varied in setting time from 25 to 40 min. (as determined by a Gillman No. 1 needle), this referred to the kettle product obtained at the "first settle." When calcined by the rotary method gypsum will set a little quicker than this.

One manufacturer who calcines at a comparatively high temperature (not less than 450 deg. Fahr.) obtains a product which sets in about 10 to 15 min. but the usual setting time for the rotary product ranges between 20 and 30 min.

The reason why the rotary plaster sets quicker is undoubtedly because it is accelerated by some of the larger aggregates which has been undercalcined, and also accelerated by a small percentage of fines which have been overcalcined or burned. This quicker setting property is a disadvantage for a few uses, and especially for some molding and pottery work.

For the reason of this quicker setting property, and also because it is bulkier, about 20 to 30 per cent more retarder is required to retard the setting time of wall plasters. The impression should not be gathered, however, that this quick-setting property is a serious disadvantage, since aside from being a cheaper product to manufacture, the rotary product has one property which is an advantage for its use in the manufacture of wall plaster (and approximately 65 per cent of all calcined gypsum made is at present converted into wall plaster of various grades). This resulting advantage is that of bulk or spreading capacity, while not over 5 or 6 per cent greater than *first settle* plaster of the same fineness, it is an advantage which is favorably considered by the wall plaster trade.

The most marked difference between kettle and rotary gypsum is found in the dry state. The latter method makes a much more fluffy, bulky, product of softer texture, and some samples have been found to have at least 30 per cent more dry bulk than sample of first settle made from the same rock.

The water-absorbing qualities and consequent wet bulk or spreading capacity do not prove to increase in ratio to the increase in the dry bulk, however. In some tests no noticeable increase has been found in the wet bulk of the rotary product, although the sample showed to have from 15 to 20 per cent more dry bulk than some kettle material. Enough experimentation has been done, however, comparing the products of both processes, to convince the writer that with the same gypsum rock the rotary process will make the more plastic product of greater spreading capacity if the proportion of fines fed to the rotary machine are kept to the minimum. In other words experiments have shown that the coarser lumps of calcined gypsum when ground give the greater bulk, and when a stream of very fine gypsum is calcined in the rotary machine, we approach the principle of the kettle method, and do not obtain much added bulk for the reason that a smaller proportion of the calcined stream is actually reground. Also, when coarse raw gypsum or land plaster is calcined in a kettle a dense plaster of low bulk is obtained, but if the material is ground again very fine this resulting product will be made much more bulky and plastic.

The practice of regrinding or finer grinding to obtain a more bulky, plastic product is no doubt widely accepted by manufacturers to promote this natural and advantageous result, but the reason why gypsum ground after calcination (as by the rotary process) is more bulky than gypsum ground before calcination (as by the kettle process) when both products are ground to the same final fineness, seems to be unexplained. At least, no theory explaining this change is known to the writer except the possibility that grinding after calcination promotes a change in the formation of the crystals in such a way that the particles are kept farther apart. This theory seems to be reasonable and may be the correct one.

Whether all rotary plaster proves to have greater water- or sand-carrying capacity when used as wall plaster, the fact that it is more fluffy and makes a larger package to place before the dealer and contractor affords a good selling point that salesmen have not failed to take advantage of, and the customer, being human, does not hesitate in many cases to grab for the larger package, assuming at any rate, that it will cover greater yardage.

The next installment of this series will give comparative figures of coal consumption required in the calcination of rotary, and *first* and *second* settle plaster, and also give specific tests and experiments comparing the physical properties of these three products.

(To be continued)

Lime Pays with Vetch

A NOTABLE demonstration of the value of lime with vetch has just been reported by E. C. Blair, extension agronomist of the State College and State Department of Agriculture, as found on the farm of W. H. Chandler of Durham county. Mr. Blair states that it is now becoming well known that lime is nearly always necessary in the growing of alfalfa and red clover, but has not been fully appreciated for use with other legumes. This demonstration proves that lime pays well with some of the others.

In the fall of 1921 Mr. Chandler applied ground limestone at the rate of 2400 lb. per acre to half of one of his fields. He left the other half unlimed. Soybeans were planted on this field in the spring of 1922, followed by rye and vetch last fall. Today, reports Mr. Blair, there is a very thick, rank growth of vetch on the lime land under discussion.

The vetch has grown so well that it has practically choked out the rye. The stems of the vetch are about 3 ft. long where the soybeans were cut for hay last fall and about 4 ft. long where the soybeans were turned under. Although the stems are matted together and bedded down, this difference is easily seen by the many visitors to the field. And then—on the unlimed portion of the field there is no vetch.

Mr. Blair states that vetch contains about five times as much nitrogen per ton as rye, so Mr. Chandler is not worrying about the rye having been choked out. He figures that the legume has gathered from the air at least as much nitrogen per acre as a 400-lb. application of nitrate of soda would supply. Potash and phosphoric acid are relatively cheap fertilizers and with the nitrogen added by the vetch and the organic matter that it supplies, together with some purchased potash and phosphoric acid, Mr. Chandler expects to make a record crop on the limed land this year. He seems to have some doubts about his corn crop on the unlimed land.

Will the Car Shortage Become Acute?

RIGHT now the railroads are loading and hauling not far from the limit of their ultimate loading capacity. No crops are moving, coal has not yet started in quantity to the lakes, construction is barely now under full way, the transportation machine is operating smoothly.

And cars are short right now!—*National Sand and Gravel Bulletin.*

Hints and Helps for Superintendents

Bracing a Building

AS a rule, when a building begins to settle or to lean from any cause whatever, it is necessary to either jack it up and build new foundations or com-

Braces like this one, made of six 2x12-in. planks and covered with tin, save the expense of rebuilding

pletely rebuild it, according to its age and value.

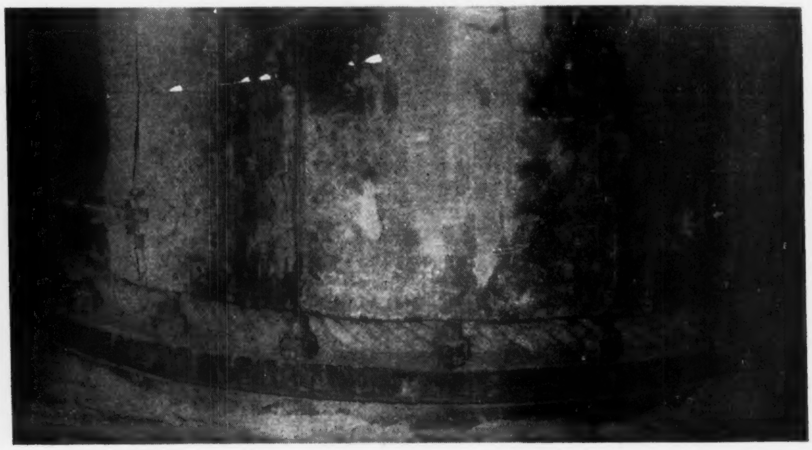
When officials of the Southern States Portland Cement Co., Rockmart, Ga., discovered that one of the buildings was leaning they had to find some means of remedying it without stopping the operation. As the building was an old one—nevertheless sturdy—and was of wooden construction, it was impossible to jack it up and put in new foundations. So the remedy found was several braces of novel design, one of which is herewith illustrated.

The braces were not intended to straighten the building but merely to prevent it from leaning further. A concrete foundation, mounted on rock bottom, was laid for each brace. Then six 2x12-in. oak planks were nailed together in such a way that they formed a solid timber 50 ft. long. This was then mounted on the foundation, being held in place by ½x2-in. iron strips, 30 in. long. The upper end was secured to one of the main beams of the building in the same way. Then the whole brace was covered with heavy sheet tin to keep the weather out of the cracks between the 2x12-in. plank.

In addition to being a protection from the weather, the tin covering serves also to improve the appearance.

Preventing Seepage

ROPES, laid around the bottom of the upper shell of the grinding mills in the plant of the Kosmos Portland Cement Co.,



How a rope can be used to prevent seepage at the bottom of a grinding mill

at Kosmosdale, Ky., are the cause of much speculation on the part of visitors.

As the illustration shows, the rope is laid on top of the lower flange between the bolts and the shell and its purpose is to prevent the escape of dust from the joint. The rope used is 1¼ in. in diameter so that in placing it in position it is necessary to force it as the space between the bolts and the shell is but a fraction more than 1 in. Thus the rope stays in place without being tied or clamped.

How a Southern company prevents stealing from its woodpile

Barbed-Wire Enclosure for Wood Fuel

THROUGHOUT the South, and especially in the Southeast, wood is used almost exclusively for fuel. This is because it has always been readily available and because the excessive freight rates on coal, to many of the more distant points, prohibits its use.

Southern producers therefore have to make provision for this type of fuel just as operators in other sections have to provide for coal. These provisions include conveyance to the plant, storage and handling. At

most of the operations wood is obtained on the property and hauled by wagons and teams or trucks to the plant, where it is stored as near as possible to the place where it is consumed.

This was the method employed by the Ladd Lime and Stone Co., Cartersville, Ga., until it was learned that wood was being stolen. Because of the great space necessary to store it a concrete or timber storage was considered too expensive. An enclosure made of barbed wire was finally decided upon as the least expensive and accordingly the one illustrated was put up. A roadway at the rear of it, the level of which is about two-thirds the height of the enclosure, permits the unloading of wagons or trucks into the storage with ease. A gate at the front permits the removal from the enclosure into cars.

Homemade Sand Screen

CONDITIONS at one operation call for equipment of special design that probably could not be used with satisfaction at a similar plant. This may be because of a difference in the material to be handled or of a difference in the finished product desired. It is because of the quality of the material handled at the Bond Sandstone Brick Co.'s plant at Lake Helen, Fla., that that company uses an unusual kind of screen.

The sand as it lies in the deposit is unusually clean and has no foreign matter in it whatever, excepting leaves and small roots. Thus, it does not need washing and it is only necessary to remove the roots and leaves. Many kinds of standard screens were tried, but none of them proved successful. It was only after much studying and experimenting that Superintendent Roberts found that a screen with wires running one way only—piano-wire fashion—was best suited.

This home-made screen is the only kind yet found that thoroughly removes roots and leaves

The illustration shows the screen installed. The wires are 6 ft. long, spaced ½ in. apart on a wooden frame 4 ft. wide. They are fastened permanently at one end and at the opposite end are attached to screw-eyes which can be tightened or loosened as required. The screen has the attention of one man to remove the rejections.

Old Truck Motor Used to Drive Pump

WATER for washing purposes is furnished the Chehaw Sand, Gravel and Mfg. Co.'s plant at Chehaw, Ala., by a 6-in. centrifugal pump. At the time the pump was installed there was no steam equipment available for powering it; also, there was no electric power. Therefore, it was necessary that some kind of gasoline or kerosene engine be installed as a temporary arrangement until such time as steam or electric power could be obtained.

There was hesitancy over the purchase of a new gasoline engine because it was intended only for temporary use. Accordingly the second-hand equipment market was looked over, with the result that an old, worn-out Kelly-Springfield truck was found whose motor seemed to be in fair condition. Upon investigation it was learned that the motor could be repaired and put into running condition at a moderate cost.

The motor was purchased and after being mounted on a special frame, made of 8-in. I-beams, it was set up and connected by its propeller shaft to the pump. Being of 40 hp., it was found to have sufficient power to drive the pump, having a 12-ft. suction and pumping through 300 ft. of pipeline under a head of 60 ft. Later, steam power was installed, but after making comparative tests it was found that the gasoline engine was less expensive. As a result it is used regularly and the steam equipment is employed as an auxiliary unit.

How a 40-hp. truck motor was connected to a 6-in. centrifugal pump

Since the time this installation was made, the Chehaw company has added another 6-in. centrifugal pump which is used for pumping sand. This unit is also driven by a 40-hp. truck motor but instead of being connected to it through the propeller shaft, it is connected by belt. The motor is the same kind as that driving the water supply pump and, like it, is mounted on a specially constructed frame made up of 8-in. I-beams. The installation of this equipment has increased the plant's capacity from four to six cars per day.

THIS is a special invitation to all operators to send in "Hints and Helps" material. Let Rock Products be your medium of exchange. Your neighbors' plants have netted material for these pages for several years and now it's YOUR turn. Merely send a sketch or photo and an explanatory note. We'll do the rest.

Cost Finding and Its Problems in the Sand, Gravel and Quarry Industries

II—How It Determines the Price Scientifically and Aids to Business Policies. Ignorance the Cause of Cutthroat Competition. Uniform Methods Would Stabilize Prices

By Alfred Baruch
Consulting Industrial Engineer, New York City

A BUSINESS of any proportions cannot be well managed today unless it employs a cost system. A man who uses it properly will never think of being guided by his competitors' prices. He will demand the price that covers the cost of his production and yields him a reasonable profit regardless of what anyone else is asking. Such a cost system raises the morale of an industry.

There are times when only the most rigid kind of economy will produce profits. It is next to impossible to practice economy without injuring the business when one does not know his costs. An additional value that a cost system has is that it clearly defines all the various elements of the business. Thus overhead is never too high when the figures are down in black and white. The reduction of overhead to increase the profits is the natural consequence of a properly maintained cost system. The installation of a cost system calls to the attention of some business men for the first time the fact that they are entitled to a salary for their personal services in addition to profits on their financial enterprise.

Determines the Price Scientifically

A cost system enables the operator to fix his prices properly and to determine his business policy. The element of chance should be removed from price-making altogether. However, there are times when an operator is actually willing to do work at less than the cost of production and for very good reasons. At such times, the only intelligent way he can determine whether it is safe to do work below cost is through the use of a cost system.

For example, an operator finds business so slow that he is willing to sell sand at cost or a little less in order to keep his men going and have some contribution made for the cost of labor and overhead. In this way he is able to avoid great losses. This, of course, is a risky business and a man cannot possibly determine just how far he may go without endangering the life of his business unless he has a complete and practical cost system to refer to.

A cost system will furnish the operator with monthly statements that will tell him, first, what the general financial condition of the business is at the end of the month; second, what the financial operation of the business has been during the month; and third, what the operating, administrative, and selling costs are.

Still another advantage of a cost system is that it sets up a standard, predetermined rate of expense with which actual costs may be compared. These standard rates serve as a budget that not only guides but also sets the limits for normal expenditures. Of course, expenses will vary from month to month; but over a given period of time, such as three or six months, they should average out almost exactly, depending on the volume of business.

It Eliminates Waste

Furthermore, the cost system will point out any inefficiency that exists. The various reports and documents used in connection with this system follow the production from the time the sand is dug until it is washed and shipped. By means of these records, it is easy to determine what time is lost, the exact individual to blame in case things go wrong, and any other leaks that may occur in the business.

A cost system properly maintained will aid in preparing bank statements on short notice. If a situation should arise demanding more money than the operator has on hand, and he is compelled to resort to the bank for a loan, unless he has the proper cost system in operation, he will have to hire an expert accountant to determine the exact statuts of his business so as to give the bank the information it wants. A cost system is indispensable, too, in preparing the numerous tax returns that the city, state, and federal governments require.

The existence of a cost system will also be a great aid in putting forward claims and collecting insurance in case of a fire. A well-ordered set of records stands a much better chance of acceptance from an insurance company than a statement drawn from the man's memory.

Government Agencies Indorse Uniform Cost Methods

The result of not having uniform cost methods in any one industrial group is unfair trade practice. So acute has this situation become that the Federal Trades Commission even undertook the establishment of a uniform cost system for manufacturers.

Only recently, Secretary of Commerce Hoover found it necessary to consult Attorney-General Dougherty on the matter of announcing the government policy to be pursued with reference to trade associations. This statement points out the advisability of permitting trade associations to find a common basis for arriving at costs and prices. This does not mean uniform prices in any sense; it means that trade associations as a whole will be given permission to use uniform methods in arriving at their prices. This is the only way that unfair competition can be wiped out.

It is not necessary for the system to be rigid so that only a certain portion of the group are able to use it. It is not even necessary that the same system should be used by all. It is really a simple matter to devise a set of systems which will fit every case in the sand and gravel and rock fields. The only point in common with the remaining systems will be that they will be based on the same fundamental principles and reduced or enlarged as the occasion demands.

A uniform cost-keeping system lays down the rules of the game. Many of the vicious practices of men in the business world are due to ignorance and not to evil intent. After all, each man is seeking some way to earn his living and it is because he does not know the way to obtain this end that he resorts to nefarious practices.

Another business fundamental is that a man is entitled to a fair profit for the work he does. In order to grasp this idea fully it is necessary to turn to the economic distinction between a business man and others. A banker invests his money expecting a definite return for his investment. As the latter is amply secured, he runs no risk, but receives only a small profit. The business man is an enterpriser. He engages to supply

the public at large. In case he has misunderstood what the public needs he stands to lose not only his profit but also the whole of his investment, which may represent his life savings. For that reason, the business man is entitled to a fair profit—in ordinary cases more than the investing banker's return.

Ignorance the Cause of Cut-throat Competition

The term "unintelligent competition" hardly needs explanation. Every operator who has tried to sell sand and gravel by figuring his costs honestly, adding a reasonable percentage for profit, is sure to have met unfair competition in some form or another, or else he is compelled to take orders at less than he knows he should get.

In a good many cases they don't even know that such a thing as overhead exists. They figure labor and material and then add a percentage for profit, thinking that telephone bills, electric light, and all the rest of the overhead expenses will pay for themselves or will sneak into the cost already calculated in some mysterious way. They believe also that by working along with their men they will be able to cut down a bit on labor costs and therefore to bid lower than reason dictates for their product.

It does not require very deep thinking to see the folly of this. A man who works with his hands can only accomplish as much as one good workman and usually not as much, because the workman is a specialist. A man who wishes to work himself instead of finding out what will have to be done and telling others to do it has no place in the business ranks. It is only those operators who have had the courage at one time or another to say to themselves that they were not workmen but business managers, and that they were entitled to a salary as such, that have succeeded.

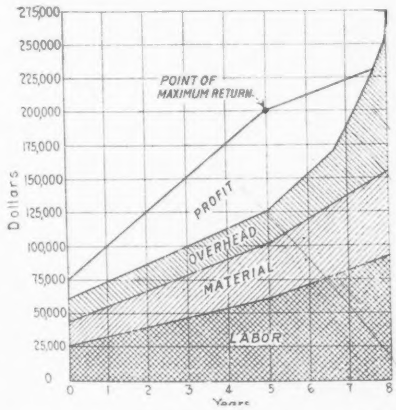
The objection has been raised that standardizing cost methods might have the effect of driving the small man out of business. This is absolutely untrue. It would bring to the small man a realization of what his true costs are and a determination to see that the price covers the cost of production and leaves something besides for profit. Through the medium of the uniform cost system, intelligently used, the operator will know or determine his limitations. Uniform costs system will never injure the efficient sand and gravel operators. It will help eliminate the inefficient ones before—not after—they damage the industry.

One result of adopting a uniform cost system would be that prices would actually tend to stabilize. The realization that one man could not grab all the orders would be finally forced on the various members of the trade and each one would maintain his price regardless of what his competitors were doing.

The Sherman Anti-Trust law and other federal regulations tending to control business were designed especially to prevent unfair price-fixing on the part of supposed competitors. However, there is nothing in any of these laws to make it appear that the business world and the public at large wish to profit by the mistakes and ignorance of any man. The Federal Trade Commission and other governmental agencies are doing everything that they can to bring light to bear on this very point. They wish to encourage trade associations in every way so as to maintain a decent standard for each particular trade. They realize that ignorance leads to unfair competition and eventually to business stagnation.

Uniform Methods Put Competitors on Same Footing

The way to avoid it, as the Federal Trades Commission itself has pointed out in numerous pamphlets issued in the last few



years, is for every industrial group to adopt uniform cost systems, so that their bidding will be on the same basis. This does not mean price agreement. It does mean that the same items of cost will be included in the price and the difference between one price and another will be the difference between one man's efficiency and his ability to run a business and another's.

In this way prices will tend to come to about the same level for those who manage their business honestly and efficiently. The only ones who will be hurt by this arrangement are the inefficient operators, who are in reality parasites on the public and the trade. Such men should be and will be eliminated. In the long run, the men who are engaged in business to give the public the service it has the right to expect are the ones who are sure to benefit by the adoption of a uniform cost system. It will eliminate all unintelligent and vicious competition and will tend to stabilize prices.

There is some point in the exercise of any business activity at which the invested capital and the invested effort will yield the great possible return. To attain this point should be the object of every business man. To surpass this point would be a foolish desire on the part of any one. A cost system would warn a man of just when that point of maximum efficiency is being approached or has actually been reached. When that time comes a man will no longer try to take away from his competitors the orders that are rightfully theirs because his costs will mount so rapidly, as indicated by his records, that he will not be able to afford it. Since there is such a point of maximum return in every business, every honest and efficient operator is sure to get a certain amount of the business to be had, provided the records are uniform and on the same basis, and all men calculate their costs in the same way. The accompanying chart illustrates this fact.

Impossible to Compare Costs if Arrived at in Different Ways

Consider how foolish it would be for John Smith to compare costs with Tom Jones if Smith based his overhead on the cost of labor and material and Tom Jones based his overhead on productive labor cost or productive labor hours, or else did not make a charge for overhead at all but included this in his so-called profit. If they really tried to compare costs under such conditions they would soon fall into the habit of misleading their competitors as to the actual costs. Each man would try to tell the other that his costs were too low and therefore the best thing to do would be to increase the price.

If all men understood their costs and if all men knew that their rivals' prices represented the amount that those men could do the work for, this unintelligent competition would be entirely eliminated. The only possible way to get all men to come to an understanding of this matter is through the adoption of a uniform cost system for the entire country. It is not fair to take orders at less than cost, or even at cost, and no man lends dignity to his trade by doing so. After all, the quantity of orders that may be had is limited and if the minimum price is high enough to insure at least one man a reasonable profit for his efforts, the whole work will have been successful. True competition is based on efficiency and skill and not on the ability of one man, or half a dozen, to deprive himself of the necessities of life in order to be able to figure the price low.

A third phase of this unintelligent competition is this: An operator will follow through this process of reasoning: "This year I did $20,000 work of business. If I underbid most of my competitors 5 per cent I will be able to raise my business the coming year to $100,000 or even $150,000." Immediately this man cuts his price in order to procure a greater volume of business. His reasoning is faulty but not enough to make him see the light until he goes through with the experiment.

As every one knows, in any community there is only a certain quantity of orders to be had in one season. If 10 per cent of the operators cut their price in order to induce a larger volume of business to come their way, they would soon lower the price of sand and gravel but would not succeed any better than they had before in getting more business. *(To be continued)*

Nature, Preparation and Use of Pulverized Coal*

By Richard K. Meade
Chemical and Industrial Engineer, Baltimore, Md.

Part III—Underlying Conditions in the Use of Pulverized Coal—Development of Firing

IT will be conceded by all that the wonderful growth of the American portland cement industry has been made possible by the rotary kiln and that the success of the latter in turn has been due largely to the use of pulverized coal. The rotary kiln is peculiarly adapted to American conditions—large output, expensive labor, and cheap fuel. As originally introduced in the industry in the early '90's, it was heated by fuel oil and unquestionably its early development was hastened by the use of this fuel, because of the simplicity of its application and the ease with which its flame can be regulated.

About 1895, however, the price of oil having risen appreciably, cement manufacturers sought a cheaper fuel. Experiments were made with pulverized coal, which proved so successful that in a few years this form of fuel was universally adopted by all cement manufacturers except those located in natural-gas belts or where fuel oil was cheaper than coal.

It was natural, in view of the almost universal use of powdered coal for burning cement, that when the rotary kiln was introduced into other industries and employed for other purposes, the use of pulverized fuel should follow it. Rotary kilns for burning lime, for desulphurizing and nodulizing pyrites cinder or fine iron ores, and for other purposes where the introduction of a small amount of coal ash will not injure the product are usually heated by pulverized coal.

Pulverized Coal in Metallurgy

In the metallurgical industries, the use of pulverized coal is increasing, due to a better understanding of the utilization of this fuel. Metallurgical furnaces are usually heated either by oil, hand-firing on grates, or with producer gas. The price of oil in most localities makes this anything but an economical fuel, while the increased wage paid to labor, added to the inefficiency of grate firing, renders this also expensive. The general tendency among metallurgical engineers is to substitute producer gas or pulverized coal for oil, while for boilers, stokers or pulverized coal are preferred. (The advantages of pulverized coal over producer-gas and stokers are explained further on.)

Among the pioneer metallurgists to adopt pulverized coal are notably: American Iron and Steel Mfg. Co., Lebanon, Pa.; Sharon Hoop and Steel Co., Sharon, Pa.; Richard Johnson & Nephew, Bradford, England; The Canadian Copper Co., Copper Cliff, Ontario; Washoe Reduction Works, Anaconda, Mont.; American Smelters Security Co., Garfield, Utah.

The American Iron and Steel Mfg. Co. has in operation more than 100 puddling, heating, and reheating furnaces using this form of fuel. The Sharon Hoop and Steel Co. is heating open-hearth steel furnaces with powdered coal. Richard Johnson & Nephew were one of the first English works to adapt powdered coal and they were employing it in 1905 for heating annealing furnaces in their wire works. The copper smelters use pulverized coal to heat their reverberatory furnaces.

In all of the foregoing industries, the application of powdered coal was com-

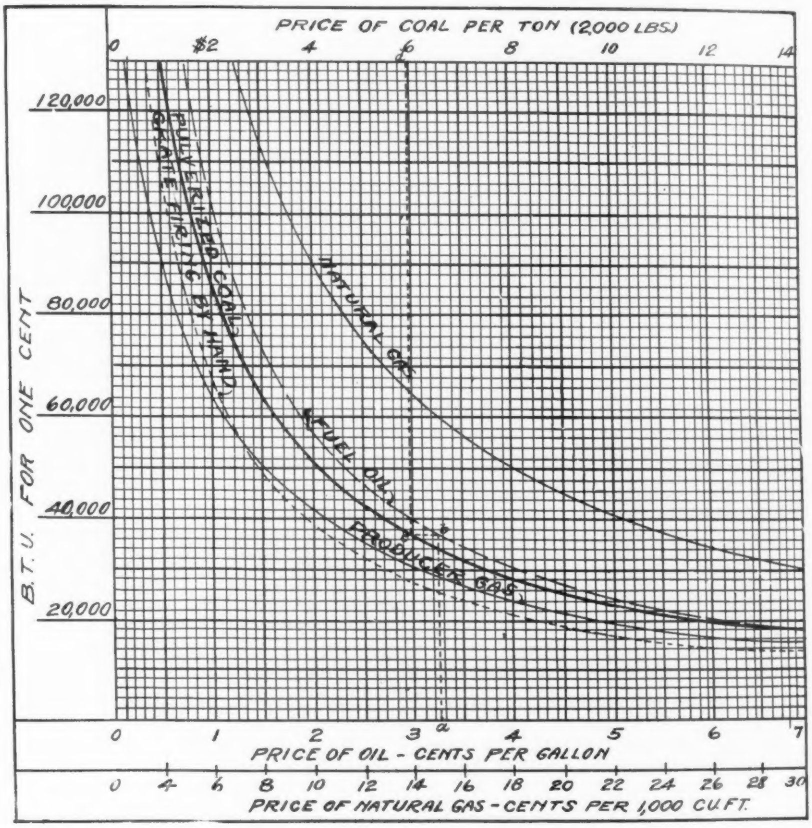


Fig. 5—Relation between cost of fuels, efficiency, and cost of preparation being considered

Note: Natural gas, efficiency, 90 per cent; cost of preparation, $0.00. Fuel oil, efficiency, 90 per cent; cost of preparation, ¼ cent per gallon. Grate firing, efficiency, 65 per cent; labor, 75 cents per ton. Producer gas, efficiency, 80 per cent; cost of preparation, $1.50 per ton. Pulverized coal, efficiency, 90 per cent; cost of preparation, $1 per ton.

paratively easy and met with but few setbacks. The details were easily worked out, owing to the similarity of the problem with others which had already been solved. The application of pulverized fuel to boilers, however, has by no means been so easy a proposition and there have been some failures. On the other hand, there have been some notably successful applications of pulverized coal to boilers.

Among the earlier boiler installations were: Michigan, Kansas & Topeka railway, Parsons, Kans.; Erie Malleable Iron Works, Erie, Pa.; American Locomotive Co., Schenectady, N. Y.; General Electric Co., Schenectady, N. Y.; Anaconda Copper Mining Co., Anaconda, Mont.

The heating of locomotives with powdered coal was experimented with about 16 years ago by the Metropolitan Elevated Railway Co. of New York City. The attempt, however, was discontinued as electrification of the lines proved a better proposition. The Chicago & Northwestern railway made some experiments in 1902 with the heating of a locomotive by powdered coal. The New York Central railway, Chicago & Northwestern railway, the Delaware & Hudson railway, and the Lehigh Valley have made experiments on the use of pulverized coal for locomotives.

Advantages of Pulverized Coal

Pulverized coal, like most other things, has its good points and its objectionable ones. The unqualified enthusiasm of those who have apparatus for sale or who are anxious to exploit some system of burning this form of fuel has possibly retarded to some extent the introduction of powdered coal. A better understanding of what is to be accomplished by its use and what problems have to be met with would, in many instances, have prevented failures and have increased the general application of this form of fuel.

Briefly stated, the advantages possessed by pulverized coal which have caused its introduction are as follows:

1. Pulverized coal is much cheaper than oil or natural gas in most localities.
2. Pulverizing is a more economical and efficient method of using coal than gassifying.
3. Practically all grades of coal, including lignite, can be burned and approximately the full thermal value of the fuel liberated.
4. If ground sufficiently fine, the entire combustible elements of the coal can be burned, thereby securing fuel economies.
5. If the air supply is properly regulated, the carbon in the coal can be completely burned to carbon dioxide and with a smaller excess of air than is possible with any other form of solid fuel.
6. Pulverized coal can be controlled with the same facility as oil and gaseous fuels, thereby allowing coal to displace these latter fuels in many instances.

The Disadvantages

The disadvantages of pulverized coal are:

1. The fact that a fairly high temperature is necessary for its efficient combustion and that it does not work well except when projecting into a furnace of comparatively high temperature.
2. The presence of ash, which cannot always be collected and disposed of so easily as with grate and producer firing.
3. The need of instructing employes in the use of and preparation of pulverized coal.

Relative Cost of Fuels

The primary consideration in adopting pulverized fuel in most cases will be the

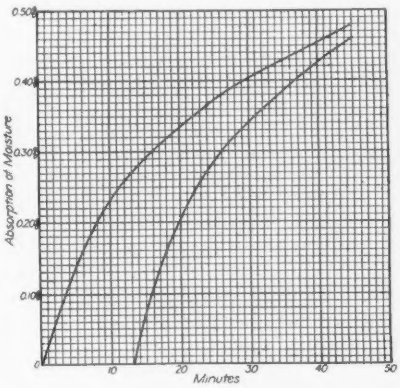


Fig. 6—Moisture absorbed by dried pulverized coal

cost of this fuel compared with other fuels obtainable, such as oil and gas. Comparison of the price of coal delivered to the plant and the cost of properly pulverizing it with fuel in use will, of course, show whether there is anything to be gained on this score from the substitution of powdered coal for other forms of fuel. In comparing the cost of powdered coal with oil, and even with coal burned in other ways, the possibility of using inferior coal should be borne in mind.

The cost of pulverizing coal will vary quite largely according to local conditions. In a general way, however, Table IV shows the approximate cost of pulverizing fuel. It should, of course, be understood that this may very materially be altered by local conditions, but it serves as a basis of comparison. Fig. 5 shows the relative cost of pulverized coal, oil, producer-gas and natural gas at various prices. Allowance has been made in this chart for the cost of pulverizing the coal, handling the oil and gassifying the coal.

TABLE IV. COST OF PULVERIZING COAL
Central Plant System

Item of expense*	Quantity to be pulverized in 8 hr.—tons			
	24	40	80	160
	Cents	Cents	Cents	Cents
Dryer fuel	8.7	8.7	8.7	8.7
Labor	33.4	30.0	20.0	16.0
Repairs	7.5	7.5	7.5	7.5
Power	15.0	15.0	15.0	15.0
Milling cost per ton	64.6	61.2	51.2	47.2
Interest and depreciation	75.0	50.0	30.0	25.0
Total cost per ton	$1.40	$1.12	$0.82	$0.73

*Note: The above costs are based on dryer coal at $6 per ton and 8 per cent moisture in undried coal, labor at 50 cents per hour and power at 1 cent per kilowatt hour. Interest and depreciation 15 per cent of cost of plant and 300 days operation, 8 hr. per day.

To use the chart in comparing two fuels, refer to the bottom of the chart, if oil or natural gas is used, and run up the nearest vertical line until the curve representing this fuel is reached, then along the nearest horizontal line until the curve representing pulverized coal is reached, and then up the nearest vertical line to the upper margin where the corresponding price of coal will be found. If it is desired to start with pulverized coal, reverse the process and start at the upper margin. For example, to find what price coal (used in the powdered condition) is equivalent to oil at 3½ cents per gallon, we find this to be $6 per ton. The dotted line *abcd* indicates the course to be followed to reach this conclusion.

Comparison Between Pulverized Fuel and Gaseous Fuels

Unquestionably, gas is the most perfect fuel because air itself is a gas and two gases can be thoroughly mixed so that each particle of one comes in contact with the other. Due to the mobility of the gas molecules, two gases confined in the same space will mix very readily. Liquid fuels do not burn well except from a wick or when atomized or sprayed. In the latter condition, a mist is formed which approaches a gas in the mobility of its particles.

If atomized by an air jet, each particle of liquid is surrounded by air and the completeness and rapidity of combustion under such conditions depend upon the thoroughness with which the liquid is converted into a mist or spray. If the latter has been thoroughly done, the liquid is broken up into a great number of very small drops or particles, each particle being entirely surrounded by air, and hence the union of the combustible elements of the oil with the oxygen of the air is rapid and complete, and it is only necessary to heat them to the temperature at which combustion (or combination) takes place for this to occur.

Relation Between Surface Exposed and Combustion

With solid matter, combustion is limited to surface action because the particles are held together by cohesion and are not free to move as is the case with a gas. In burning solids, therefore, the rapidity of combustion depends upon the surface exposed to the air, hence by increasing the

surface of the solid in contact with the air, quicker combustion results.

One way of increasing surface is to flatten out a mass of material, as, for instance, the rolling or hammering of a bar into a sheet. An even more efficient way is to subdivide it into many parts. For example, a cube having an edge measuring 1 in. has a surface area of 6 sq. in. If this is rolled into a sheet 0.01 in. thick it will present a surface on all six sides of 204 in. If, on the other hand, this cube is divided into small cubes each of which will have a side measuring 0.01 in. there will be 1,000,000 of these cubes each with a surface area of 0.0006 sq. in., or a total area for all of the cubes of 600 sq. in.

It will be seen, therefore, that if we pulverize a solid we increase enormously the surface exposed. If we tried to burn pulverized coal on a grate, difficulty would be encountered in supplying air because, as I have said, when we burn coal on a grate the air is supplied largely by sucking the latter through the pores in the fuel bed and the pulverized coal would form a compact mass through which air would not pass. When pulverized coal is blown into a furnace, however, the coal is suspended in air. Each particle of coal is surrounded by air, the cloud of coal and air approaching very closely to a gas mixture and combustion is very rapid.

We have here a case similar to that which occurs when oil is atomized, but instead of drops of oil we have little particles of coal. Indeed, when the coal is finely pulverized, the conditions are better than with a highly viscid oil, because such oils are very hard to spray properly and give large drops rather than a fine mist. This is the theory upon which the efficiency of pulverized fuel is founded.

It will be seen that if we have a coal sufficiently finely powdered and blow it into the furnace with just the right quantity of air for combustion, the only other condition necessary for complete combustion is that the coal and air shall be thoroughly and uniformly mixed. Fortunately, we can obtain apparatus with which coal can be pulverized to the requisite degree of fineness and we can also obtain apparatus by which a uniform quantity of coal and air can be properly mixed.

As a result of this ability to surround each particle of coal with air, we can burn the coal with practically the theoretical quantity of air, so that the ash resulting is free from carbon. We can also burn practically all the carbon to carbon dioxide, so that there is no loss of heat from the formation of carbon monoxide.

Comparison of Pulverizing with Grate Firing

Comparing pulverizing with other methods of utilizing coal, such as hand-firing, stokers, gas-producers, etc., the advantages are generally in favor of pulverizing. The losses which occur with hand-firing in the matter of excess air used for combustion, unconsumed coal in the ash, and carbon partly burned to carbon monoxide, are eliminated. The stoker is an improvement over hand-firing, but these losses still occur with greater or less degree. Both the stoker and hand-firing require selection of the coal and often exclude the use of the coal cheapest and nearest at hand. Stokers are particularly exacting in their requirements in this respect, and often, if they are to operate with any degree of efficiency, the coal must be carefully selected as to kind and size. This makes them highly dependent on a particular source of coal and any accident to this supply frequently puts them out of effective condition. The stokers also have the disadvantage in that metallic parts are exposed to the action of the heat.

With pulverized coal, the choice of coal covers a wide range as to size and quality and no metallic parts are exposed to the heat. A pulverized coal installation is much more flexible than stokers and the boilers can be forced to a high rating, thus giving the ability to take care of peak loads. With pulverized coal, fires can be instantly extinguished in case of accident by shutting off the coal.

Comparison of Powdered Coal and Producer Gas

Powdered coal has the advantage over producer-gas firing in that the internal losses of the gas-producer are overcome. These losses are by no means small. It is estimated that the average loss of heat in the gasification of fuel, due to complete combustion to carbon dioxide, heat radiation from the top and sides of the producer, the carbon which the ash carries away with it and the coal consumed in the boiler for the production of the steam required for the gas-producer, is at least 20 per cent of the thermal value of the coal.

Where the coal is burned directly in the furnace itself, all of its energy is liberated at the point of application and there is no loss other than that from the furnace itself, such as the heat carried off by the waste gases, slag and charge and that lost by radiation. These latter losses occur, of course, equally with all fuels.

As we have stated, it is possible by means of powdered coal to obtain a much higher temperature than is possible with gas-firing.

For example: The theoretical temperature of combustion of cold producer gas of the composition: CO_2, 5.8%; O, 1.3%; CO, 19.8%; H, 15.1%; CH_4, 1.3%; N, 56.7% burned with 25 per cent excess air, is only 2598 deg. C., while the theoretical temperature of combustion of coal of the composition H_2O, 1.9%; C, 74.9%; H, 4.8%; O, 8.6%; N, 1.4%, when burned with 25 per cent excess air, is 3182 deg. C. Hot producer-gas is usually employed for heating lime kilns and metallurgical furnaces, in which event the sensible heat in the gas serves to raise the flame temperature. The gas employed for rotary-kiln work is usually around 1300 deg. Fahr. In this event a flame temperature of about 3000 deg. Fahr. is possible.

It is also possible with powdered coal to obtain a much more regular heat than can be obtained from producer-gas. With the old-style hand-poked producer, the gas is very irregular in composition, and with even the most modern mechanically fed and rabbled producers, unless they are very carefully handled, the composition is irregular, while with pulverized coal, if improved methods for projecting this into the furnace are used, it is possible to furnish the furnace not only with a fuel of uniform composition and in regular quantity, but also to so regulate the air as to burn it to the best advantage. With pulverized fuel, no ash has to be handled and much poorer coal can be utilized. On the other hand, producer gas is cleaner than pulverized coal and there is no ash to settle on the charge.

The cost of the two installations is about the same. Hand-rabbled producers cost about the same as the small unit coal pulverizers used to pulverize and blow the coal into the furnace in one operation, while the large mechanically operated producers are fully as expensive as a central coal-pulverizing plant.

(To be continued)

Italy's Fertilizer Output Increasing

ITALY'S superphosphate plants have a present potential capacity of some 1,300,000 to 1,400,000 tons a year, according to advices received by the Department of Commerce. Actual production, however, has not yet reached this figure, the output for 1920 being estimated at 900,000 tons against 673,000 tons in 1921 and 665,000 tons in 1922.

The crude phosphates required by the industry are imported almost entirely from Algiers and Tunis, this African material permitting the manufacture of low-grade superphosphates (from 14 to 17 units). American rock is used for high-grade superphosphates (from 16 to 20 units), but the American crude phosphate is more difficult to grind, is considerably more expensive, and requires a larger quantity of sulphuric acid for its decomposition than the African.

Present-day consumption of superphosphates in Italy is perhaps 10 to 15 per cent below the pre-war annual total of 1,000,000 tons—apart from 130,000 tons of phosphatic (Thomas) slag imported—upper Italy, Tuscany and Marches accounting for about 80 per cent of the total.

The nitrogenous fertilizers used here are for the most part imported. However, Italy has recently begun the manufacture of calcium cyanamide, and the output is rapidly increasing, having been 16,000 tons in 1921 and an estimated 25,000 tons in 1922.

Great Progress in Development of Lime Building Products

Quick-Setting Lime Plaster and Lime Tile and Partition Blocks Are Results of the Year's Activity of the National Lime Association

THE outstanding features of the past year's work of the National Lime Association, which held its annual convention in New York City, June 13, 14 and 15, were the exhibits of panels of quick-setting lime plaster and the numerous tiles and blocks made practically entirely of lime. These exhibits were supplemented by reports and papers and moving pictures, which could not do otherwise than greatly impress the construction industry as well as the lime industry with the tremendous possibilities the future holds out to lime manufacturers.

The development of these new lime building products is the result of a thorough, accurate, scientific exploration of the entire field of chemistry as related to lime and lime compounds, and of the possible commercial application of the knowledge thus gained. All the products developed, and the processes used, will be covered by patents owned by the Association, and it will be the general policy of the Association to license its members to make full use of such processes under proper supervision and with necessary technical assistance.

No claim is made at this time that the products thus developed are ready for the market. Much testing and experimentation is still to be done. Nevertheless, progress has been such as to prove that the objects aimed at are now within the range of commercial application, and that with proper supervision and control continued progress in the same direction will make lime one of the most essential materials in a variety of building products. The most surprising discovery was the strength that lime will develop under the manipulation and processes used.

Lime is perhaps the most ancient manufactured building product and the attempt to find new uses for it, or new properties in it, was looked upon by scientific men, both in the Association and out of it, with a good deal of skepticism. Starting out to prove that the objectives could not be accomplished, the investigators were both disappointed and surprised. The results were accomplished by a few months' intensive application of the energies of the whole staff of the Association, under the inspiration and direction of President Charles Warner and General Manager W. R. Phillips.

Organization of the Association

Other than technical developments, probably the most important transaction of the convention was the preservation of a strong central organization to deal with matters of policy which will inevitably arise from the technical developments of the industry. While the divisional organizations will have greater freedom in the matter of regional promotional work, no lime manufacturer will be allowed to belong to the divisional organizations without subscribing to the support and to the principles of the central, policy-determining national organization; although lime manufacturers may join the national organization without necessarily taking part in the divisional, or regional, activities.

George B. Wood, newly elected president of the National Lime Association

The scheme of central organization developed by Mr. Phillips during his term of general managership will be preserved, with the possible exception of direct promotional work. However, as Mr. Phillips pointed out, in what follows, complete divorce of the promotional work from the central organization can never be actually accomplished. Mr. Phillips described the present organization as follows:

First, an *executive office* having to do with the business administration of the Association's affairs;

Second, a *headquarters' technical office* having to do primarily with matters of research; and,

Third, a *field service organization* composed of an Eastern Division and Central Division, each with its respective manager. These have to do with obtaining specifications for lime and helping consumers in its use.

The functions of the Association have been accurately described under the headings of *Research, Education* and *Promotion.* It is, however, a great mistake to assume that *research* belongs to the *technical* organization alone, and that *promotion* belongs to the *field* organization alone. The facts do not justify this common misunderstanding, for some of our most valuable research work has been done by the field, and some of our most valuable promotional work has been done by the technical headquarters' organization.

With these facts in mind, I will cover very briefly the high spots of the past year in the different parts of the organization.

Executive Offices—The executive offices under the personal direction of the general manager have to do with:

First, matters of membership and finance;

Second, the co-ordination of research work and field work;

Third, the handling of special or emergency cases;

Fourth, the determination of what is the most important thing to be done next; and

Fifth, the direction of all the Association's forces, both field and research, toward that end.

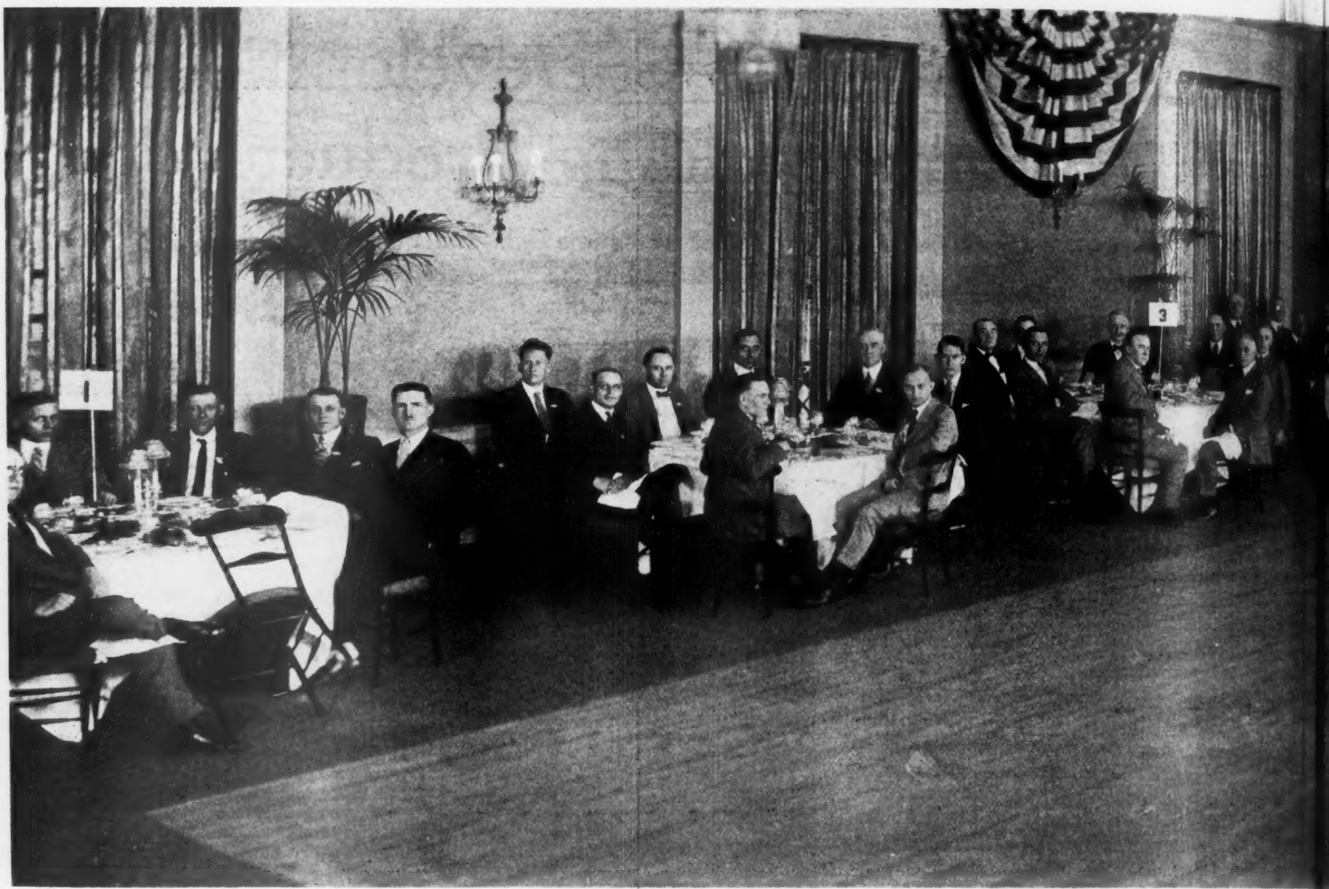
Membership and Finances — Reports covering membership and finances have already been presented in a former session. It is sufficient to say here that the Association has in the past year increased its expenditures in the interest of the industry by more than two times that of any previous year.

Co-ordination of Research Work and Field Work—The field work and research work have run together smoothly during the year. Both have been expanded greatly in keeping with the plans laid down at the last national convention.

In this connection, there are two facts worthy of special mention:

First, our fellowships are supplying the full-time service of from 12 to 15 men in technical studies of lime under the personal directions of some of the country's greatest research minds.

Second, our own field staff of about 20



Banquet and entertainment given to the lime manufacturers of America, assembled at their twenty-fi[rst] annual m

men is daily serving consumers in both divisions and putting lime in many specifications where it would not otherwise appear. They are covering all three fields—construction, chemistry and agriculture.

Determination of Most Important Work—During the past year important projects amounting to no less than 25 or 30 in number have been presented to the Association for its attention.

If we were to attempt to handle all of these problems at one time, the Association would find itself swamped in a multiplicity of effort without being able to completely accomplish any one thing. Careful selection of those things that are to be undertaken is therefore of primary importance to the Association's success.

I think it is appropriate that a number of the projects that have been presented to the Association this year should here be enumerated:

1. The making of quick-setting lime.
2. The making of ready-mixed lime plasters and mortars.
3. The treatment of subsoils in highway construction with lime.
4. The substitution of hydrated lime as a filler in asphalt in place of ground limestone or cement.
5. The making of a structural lime block.
6. The training of new men for field work.
7. The obtaining of recognition for lime in building codes.
8. The making of a satisfactory specification for lime in plaster.
9. The publication of handbooks on lime in construction, agriculture and chemistry, so as to provide in one book all available knowledge of commercial value in promotion and use of lime.
10. Tests to determine fire-resisting qualities of lime plaster on metal lath.
11. The publication of approximately 50 different bulletins relating to subjects not yet covered by lime publications.
12. Establishment of schools for plasterers and bricklayers.
13. Disposition of limestone fines wasted at crushers.
14. The making of calcium arsenate to exterminate boll weevil.
15. Transportation and car service.
16. Income tax services.
17. Employers' liability insurance and fire insurance.
18. Establishment of department to deal with production problems.
19. Education of member company salesmen.

From the above list, we selected for this year's work two major projects, namely, the making of quick-setting lime and the putting of lime in highways on a large scale.

It is, of course, not practical to abandon all other work in favor of these so-called "major undertakings;" they are merely given preference over less important work. The general work of the Association must be kept in motion as the conditions require. This has been done, as reports following later in the program will show, and, in fact, the *lime block* projected itself into the list only within the last few weeks.

While the foregoing list does not by any means cover all that should be done in the near future, yet it gives you an idea of the size of the task that is immediately ahead, and the work that must be provided for if the Association is to serve the purpose for which it is maintained.

Headquarters' Technical Office—In our general plan of operation it is primarily the function of the headquarters' technical office to conduct research work and supply technical information on all subjects relating to lime.

This involves research work in our own laboratories and in different colleges, coordination with other technical societies and the writing or reviewing of all technical literature and articles published by the Association.

The work of the headquarters' technical office is, however, not confined entirely to research and publicity work. It also does a great deal of field work for which it is particularly qualified, and is constantly aiding the division field forces on special projects.

Co-operation Between Headquarters and Field Organizations—Co-operation between the Washington office and the former bureaus of the Association did not exist in former years as it should have existed, but it is fitting here to say that the co-operation between the division managers and the general manager, in all matters throughout this year, has been of the very highest type, and we feel that to this fact more than to any other single fact is due the progress that has been made in the last few months in the face of a large number of difficulties.

... twenty-fi[illegible]t annual meeting, by the Valve Bag Co. of America, Hotel Commodore, New York City, June 14, 1923

Expects Increasing Use of Lime in Agriculture

The desire for quick returns and avoidance of long-time investments, because of the increasing growth of tenant farming, may entirely change the present practice of the corn-belt states in soil liming, according to John A. Slipher, soil technologist of the Association, who reported as follows:

In recounting the work of the technical agricultural office of the Association, only the more important activities will be dealt with.

Looking back over the year, attention may be called to the following specific accomplishments and projections of work in behalf of liming and burnt lime:

Holding of First National Liming Conference—A liming conference of national scope, the first in history, was held at the University of Tennessee in September of last year. This conference marked a step in advance for both science and practice. Its achievements and effects have served some valuable purposes on both the investigative and commercial sides:

(1) *Planted Clearer Idea of Wide Need for Lime.*—First, the conference accomplished much in the direction of crystallization of opinion on many points with reference to liming. It revealed to the many agricultural workers present the enormous field for the extended use of lime on the land, and contributed much information toward a more rational method of using liming materials. The essential place of lime in modern agriculture was driven home and this impetus was particularly fortunate in the case of the Southern states where there has been a marked lack of appreciation of the essentiality of lime for a productive agriculture.

(2) *Accelerated Interest and Gained Converts.*—Again the mass effect of this conference was to accelerate interest in the field on the part of present workers which will be reflected in increased energies being turned toward liming studies. More than in other forces, this conference has served to awaken the indifferent.

Technical Conferences—The agricultural office has actively engaged in several conferences dealing with technical matters of broad concern.

(1) *Agricultural Subcommittee of A. S. T. M.*—Much work was done with the Agricultural Lime Subcommittee of the American Society for Testing Materials and this year has marked the inauguration of two important lines of work, one of which is well on the road to completion. The first of these is the study on relative solubility of graded limestone separates. The other has to do with standardization of lime, both quicklime and hydrated lime, for spray making.

(2) *Active Work With Crop Protection Institute.*—This office represented the Association at the annual convention of the Crop Protection Institute held in January. To the burnt lime industry the activities of this institute are becoming increasingly important because of the revolutionary changes in certain measures of spraying now being evolved. Burnt lime enters into a large percentage of these spray mixtures.

(3) *Other Conferences.*—This office was represented also at the annual meeting of the American Society of Agronomy and the Association of Official Agricultural Chemists.

(4) *Evaluation of Soil Limes Adopted in U. S. G. S. Lime Report.*—In the past, agricultural limestone and burnt lime products for soil improvement have been reported in terms of gross tons of material in the official lime report of the United States Geologic Survey. Because of the wide difference in strength of these two types of material, this method of reporting necessarily has not presented the relative importance of these two materials in true measure. To correct this, the N. L. A. method of evaluating liming material, namely, on the basis of both chemical and physical analysis, has been applied in the Geologic Survey Report for 1921, in which is to be found the comparative production of burnt limes and limestone for agriculture expressed as "effective oxides," or, in other words, on the basis of a comparative field strength.

Educational Material Prepared and Issued—The educational phase of the agricultural work has been maintained along consistent lines of what are recognized as the primary means of reaching our most

influential contacts. The types of material have been:

(1) *The Agricultural Lime News Bulletin.*—By the official organ of the agricultural field, namely, the Agricultural Lime News Bulletin, the aim has been to keep before the public the fundamental place of lime in land prosperity and food production. Coincident with this there is brought to the foreground the proper parity of burnt lime as compared with other lime-carrying materials suited for soil treatment.

In the seven issues there has been covered a wide variety of subjects ranging from the

Fred Witmer, vice-president

semi-scientific to the economic and practical. Some of the more typical subjects have been: The advance of the need for lime into Kansas; the relative solubility of hydrated lime and raw carbonates. To the exclusive credit of burnt lime are its advantages in cutting the cost of crop production through the double effect of lengthening the working season and in rendering tillage easier. These are aspects of liming that have been overlooked, yet they are ones of practical concern to the farmer. From time to time we are blasting away that old hoax about nitrogen waste resulting from the use of burnt lime. This vicious nightmare which has hung around liming circles 15 years is now pretty well dispelled, especially in influential quarters. Also, due attention has been given to the utility of lime for feeding gains and economy in livestock rations, as has also the functional value of lime in farm produced feeds, which is possible only by an adequate supply of lime in the soil.

(2) *Original and Reprinted Articles.*—The trade and public press, both national and local, multiply the effectiveness and distribution by reprinting the material issued in the News Bulletin.

(3) *Cabinet Sets of Soil Limes.*—The demand for cabinet sets showing representative soil liming materials has far exceeded the original supply issued in June last. The additional supply has been built and distributed to county agents and vocational teachers of agriculture upon their specific requests. More are now under construction.

(4) *Lantern Slide Sets.*—Nine sets of lantern slides have been completed and are now

Milton McDermott, treasurer

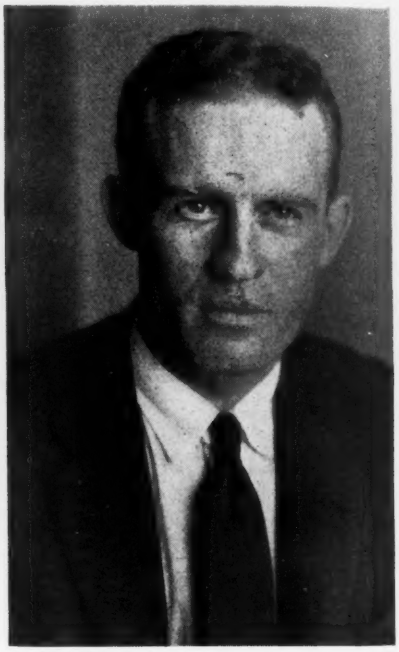
in active use. These are issued in sets of 60 slides each to county agents and soil specialists before farmers' groups such as the farm bureau, grange and similar bodies.

(5) *Pennsylvania Lime Exhibit.*—For the third consecutive year, the Association has exhibited at the Pennsylvania State Farm Products Show at Harrisburg. This show was attended by approximately 40,000 farmers representing all sections of the state. The message of soil lime, which farmers at such meetings receive and carry home, will in most cases reach beyond the confines of their own farm and spread throughout the neighborhood.

W. R. Phillips, former general manager

New Construction Literature

R. P. Brown, construction engineer, described the preparation of new literature on the use of lime in construction including the Construction Section of the Salesman's Manual.



Burton A. Ford, acting secretary

This consists of approximately 90 pages of printed matter, presenting the advantages and proper use of lime in an easily grasped style, together with a brief summary of the salient features of competitive materials. Supplementing this first section of the manual are approximately 120 pages of data, consisting of tables, charts, results of field and laboratory tests, testimonial statements, specifications, etc.

In this work practically all the available information on lime in construction has been gathered into one compact and usable volume suitable for a ready-reference book. It has been issued in loose-leaf form as a confidential document for member companies only, and will be kept up-to-date by revisions and additions as new data and material become available. The publication has been well received by the industry, and 190 copies have already been placed in the hands of our field men, officers and salesmen of our member companies.

Bulletin 308, "Lime in Concrete," which consists of a series of pictures, together with facsimile letters from the engineers, architects or contractors who designed or erected the structure, was issued early in the year. This bulletin proved to be particularly valuable in the field, and during the past year 15,000 copies have been distributed!

Bulletin 301, "Watertight Concrete," was completely revised and brought up to date during the past year, and has filled one of

John A. Slipher, soil technologist

the needs for adequate promotional literature.

Manuscript has been prepared and is ready to be published for Bulletin 300-A, "Lime and Lime-Cement Brick Mortar," and Bulletin 305-A, "Standard Specifications for Lime Plaster," material has also been gathered for another edition of letters from engineers,

Dr. Major E. Holmes

architects and contractors relative to the advantages derived from the use of lime.

An extensive mailing list, which has been used by both the Eastern and Central Divisions, has been prepared. This list is at present composed of 6458 architects, 2392 engineers and builders, 234 railroad engineers, and 1908 state and county engineers, together with 208 engineering professors and laboratory heads, making a total of 11,200 names.

Wonderful Future for Lime in Highway Construction

A brief report of W. A. Freret, special representative of the Association, on the prospects of using increasing amounts of lime in highway construction was extraordinarily interesting and encouraging. The use of hydrated lime in concrete pavement mixtures to increase workability of the

Dr. G. J. Funk, chemical director

mixtures is only one of three probable extensive developments of lime in this field.

Experiments in the use of lime for treating compact clay soils under pavements to increase drainage facilities and prevent the destruction of the pavements, as well as to improve earth roads, originally suggested by W. E. Carson, former president of the Association, have proved most interesting and valuable. Experiments in the use of lime as a filler in asphaltic and tar road binders and cements are under way which may revolutionize practice in this field. And the use of lime and whitewash along the highways is growing by leaps and bounds; and though the tonnage involved in this is comparatively small, the advertising value for lime may be of great value.

Lime as an Asphalt Filler

In co-operation with the Chicago Paving Laboratory the investigators of the National Lime Association reported results of ex-

W. A. Freret, special representative

periments with lime as an asphalt filler as follows:

In general it may be said that asphaltic and similar pavements consist essentially of an aggregate, a filler and a bituminous or asphaltic material. The percentage of the asphaltic material usually lies within the range of from 7 to 12 per cent. The percentage of filler usually lies within the

R. P. Brown, construction engineer

range of from 7 to 21 per cent.

The fillers which are now in use are limestone dust and portland cement. In view of the fact that extreme fineness is one of the fundamental requirements of a filler, it is obvious that hydrated lime, which is extremely fine, is well worth consideration. Before any conclusion could be drawn regarding its ultimate value, however, it is desirable to know what the effect of the lime on the asphalt itself is as compared with portland cement and limestone dust.

Tests were made to determine the relative effect of these fillers on the melting point, penetration, maximum tensile strength and cementing value of the asphalt. The reasons why these particular tests are the all-important ones is apparent when it is remembered that the chief defects that are apt to develop in asphaltic pavements and which can be attributed in part to the asphaltic mixture itself are the following:

a. Surface displacement or movement which may be forward or lateral depending upon the kind of traffic.

b. Cracking.

c. Raveling.

The first of these defects is by far the most important in this investigation because the latter two defects are affected much more by other factors than the filler itself. The investigation has centered around the factor that may affect surface movement which obviously depends upon a high melting point, low penetration, good cementing power and high tensile strength of the asphalt as affected by the filler.

The limestone dust and portland cement used in these experiments represent the quality of these materials ordinarily used for this purpose. The limestone dust is 85 per cent through 200 mesh. The portland cement is 81 per cent through 200 mesh. The hydrated lime is regular commercial material. It happened to be a high calcium hydrate but we know of no reason why an equally fine magnesium hydrate would not be equally satisfactory. The asphalt is the Texaco brand, typical of the material suitable for average paving conditions in the vicinity of Chicago, and it tested as follows:

Penetration at 77 deg. Fahr., 58.

Melting point (ball and ring method) 130 deg. Fahr.

Maximum tensile strength, 1.8 kg. per square centimeter.

In each of these four all-important tests (effect on melting point, penetration, tensile strength and cementing value), hydrated lime shows up to advantage. The question has been raised as to the ultimate chemical effect of the lime on the asphalt. A test was therefore made to determine whether the properties of the asphalt itself were altered by the action of the lime. A mixture of 45 per cent hydrated lime and 55 per cent asphalt having a penetration of 46 at 77 deg. Fahr. was made up and tested for penetration. It gave a penetration of 11 at 77 deg. Fahr.

The bitumen was then extracted and separated from the lime and it was found to give its original penetration of 46, indicating that no chemical change had taken place in the asphalt as a result of the action of the lime. The prediction therefore may be made that the effect of the lime would be permanent and lasting and that there would not be undue deterioration. The result is in marked contrast to that obtained with certain oxidizing chemicals sometimes used.

So far this report has not dealt with workability. It is possible that a material might increase the melting point, tensile strength, and cementing value and yet so adversely affect the workability of the mixture that it would not be practicable for use. The Chicago Paving Laboratory is quoted as follows on that point:

"The workability in operation will largely be a matter of temperature. It is true that the hydrated lime stiffens the mixture considerably more than any of the fillers ordinarily used. This can largely be overcome, we believe, by operating at higher temperatures and still keep same within the range of safety so far as the asphalt itself is concerned. The only time that the use of hydrated lime might prove to be a real disadvantage from this standpoint would be in the case of an extremely long haul when the load of hot mixture would have a tendency to chill somewhat before being delivered to the work. We would anticipate no extreme difficulty along this line as we believe it can be worked out satisfactorily under actual operating conditions."

Conclusions—The results of this investigation indicate that the use of hydrated lime as a filler in asphaltic paving mixtures bears promise of overcoming or minimizing the distortion or displacement under traffic. This effect should result from the stiffening which results from the effect on melting point, penetration, cementing value and tensile strength. It may be desirable to use the lime alone as a filler or in combination with other fillers.

The use of hydrated lime as a filler may also make possible the use of softer bitumens than are now used. Until recent years, relatively soft bitumens were used, but with the change in motor traffic in recent years it has been necessary to use harder bitumens. The softer bitumens have certain inherent advantages particularly in regard to absence of cracking in very cold weather, and with hydrated lime it may be possible to bring these soft bitumens into use again.

The use of hydrate has another possible point in its favor and that is the use of a relatively small amount of it to get the same effect as is obtained with a large amount of the other fillers.

Recommended Mixture

We would recommend for trial the following mixture:

	Sheet asphalt	Asphaltic concrete per cent
Bitumen	10.8	6.5
Hydrated lime	16.1	11.0
Aggregate passing 80	32.4	7.3
Aggregate passing 40	34.7	11.8
Aggregate passing 10	5.4	9.2
Aggregate passing 4	.6	16.5
Aggregate passing 2		24.9
Aggregate passing ¾ in.		5.8
Aggregate passing 1 in.		7.0

New Chemical Uses of Lime

In the report of the Chemical Director attention was called to new developments in the use of lime in the chemical industries, including:

The purification of gasoline with calcium hypochlorite, the carbonation of softened water to prevent after precipitation in the mains, restoring the color or ivory, recovery of ammonia in sugar clarification, clarification of corn oil and castor oil, preservation of cereal foods, improvements in the manufacture of sodium hypochlorite, treatment of lampwicks, suppression of the growth of fungi in sugars, packing of crude caramel, renewing the color of marble, improvements in the unhairing of hides, reducing manganese ores, oxidizing liquid hydrocarbons, the pressure heating of peat to make calcium salts and byproducts, and the manufacture of artificial milk, artificial leather, substitutes for ebonite, organic products which employ condensation reactions, dental cements, cellulose solvents, casings for pencils and the like, a new leather grease, ultramarine pigments, ammonia by the electrolytic reduction of nitrates, match compositions, new bleaching compositions, mannose, phenylacetaldehyde, methyl violet, crotonaldehyde, new lubricants, black glass, printers' rollers, paint from tar and lime, pure lactose, new absorbents for gases, new water-proofing mixtures for cements, leather-softening oil, carriers for catalytic materials, artificial honey, calcium hydride, food dressing, textile fibers from new raw materials, hydrocarbons from lignite, mastic from sulphite lye, insulating paper, fire extinguishing compositions, astringents, coatings that prevent end checks in wood, reducing agents, organic oxides and coatings for the interior of concrete tanks.

Complete Index of Lime Literature—We are card indexing all the published information on lime that comes out in American or foreign publications. This has proceeded to a point where we are beginning to function effectively as a central clearing house of information on lime both to the member companies and users of lime. A member recently had occasion to know the uses of calcium phosphate that duplicated the uses of lime. He wanted to apply for revision of freight rates on lime and wanted to know wherein the two materials were equivalent. We had the material at hand and sent it out promptly.

We are prepared to render much service of this kind to the member companies which we believe is not generally known to you. A user recently had occasion to have reference to all the processes of extracting magnesium from dolomite. These references were sent him by return mail. Such service helps us to get lime in use and keep it in use.

Lime Partition Block

Credit for the conception of a lime building block and the development of a commercial process for manufacturing such a block is due to the co-operation of several agencies. These experiments grew out of research work of the United States Bureau of Standards on quick-setting lime plasters. Twenty-five mixtures were experimented with in the manufacture of 30 blocks and tile.

Having determined that mixtures of quicklime and hydrate, cinders, sawdust, sand, asbestos, wood fibre, etc., would set rapidly enough for the blocks to be handled, and that the blocks would gain sufficient strength for use in a few days, W. A. Freret worked out, in conjunction with R. H. McElroy of the International Clay Machinery Co., Dayton, Ohio, a feasible commercial method of manufacturing the blocks, which was illustrated at the convention by a motion picture.

Mr. Freret said, in describing the developments:

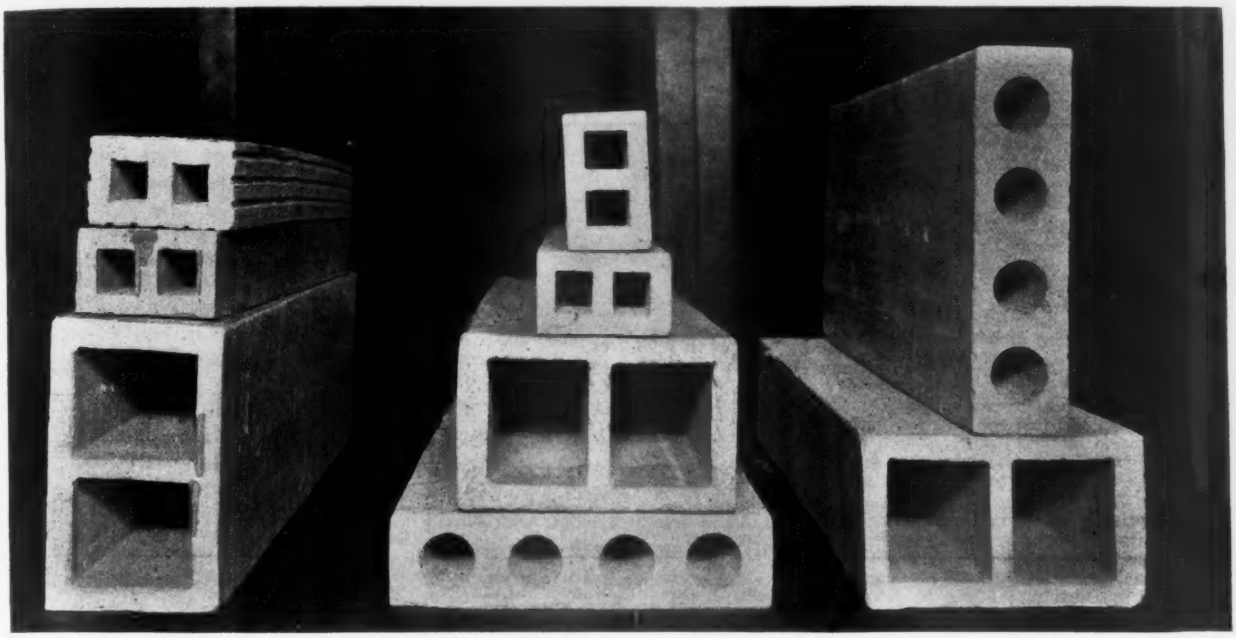
The results of the experiments at the Bureau of Standards, carried on at home, were extremely promising, so that with Warren E. Emley's co-operation, a small 6-in. auger machine at the Bureau of Standards was put to work and again a successful block was made. The specimens made on this small machine proved so encouraging that it was determined to experiment on a large scale and prove or disprove whether the block could be made commercially.

Extensive experiments were then carried on by me at Dayton, Ohio, in the plant of the International Clay Machinery Co. After many discouraging weeks a block was made which, when finally perfected, we believe will fill a long felt want in the construction field.

There are 22 mixes used in making these 30 blocks and three different types of dies were employed. Mr. Emley will tell you of the tests which were made by him on these blocks at the Bureau of Standards and of the results obtained. He will also, I hope, tell you that he believes we have fine prospects of making a very good building block which will compete, not only with gypsum, but with cement and clay tile as well.

The entire product and process are covered by patents applied for. There still remains much work to be done before we can say that the product has been entirely perfected, although at present it is in a commercial form. There are many ways in which we believe the present block can be improved, and there are many materials which might be advantageously employed as fillers. We are not yet ready to say that the auger machine is the best possible one.

Mechanical cutting and handling devices as used at present for clay products will have to be slightly changed to handle this material, but I do believe that I have produced a block which can be made into a much desired building unit, and I feel that a lime company manufacturing lime building blocks will have an outlet for a large tonnage of lime, and that this new product will act as a stabilizing factor in the manufacture of lime. There should be no period of curtailed production of burned lime, for when the market is not ready for burned lime it can all be turned into building blocks, which continually improve with age. They can be stored in the open, not requiring special cover.



Lime tile and partition blocks developed by the National Lime Association

Quick-Setting Plaster

The work of developing a quick-setting lime plaster was divided among various laboratories and research organizations. At the Massachusetts Institute of Technology, under the supervision of R. T. Haslam, director of the laboratory of applied research, studies of the fundamental chemistry of compounds of lime water and carbon dioxide were made. (An abstract of Dr. Haslam's report will appear in a subsequent issue.) At the University of Indiana F. C. Mathers, professor of inorganic chemistry, directed a study of carbonated hydrated lime as a basis of quick-setting plasters. (An abstract of this report will be published in a subsequent issue.) The effect of burning conditions, such as the temperature and time of burning, on the time of set of lime plaster was investigated at the Ohio State University under the direction of James R. Withrow, professor of industrial chemistry. Dr. Withrow's experiments, while showing that conditions of lime manufacture were of secondary importance in the solution of the major problem, nevertheless bring out some exceedingly interesting and valuable data for the lime manufacturer to know.

(Dr. Withrow's paper, together with that of Victor J. Azbe, combustion engineer, St. Louis, Mo., on the efficiency of lime burning, will form the basis of a discussion of lime manufacture in a subsequent issue of ROCK PRODUCTS which will constitute a most important contribution to the literature of the subject.)

In addition to the work done in the laboratories mentioned a very exhaustive study of lime compounds is being carried out in the Association's own laboratory.

A general summary of the quick-setting lime-plaster problem was reported by the chemical director of the Association as follows:

The quick-setting lime plaster problem involves the development of a plaster consisting primarily of lime which retains all those properties which has made lime plaster pre-eminent for centuries, and in addition will have the property of setting up ready for the second coat within a few hours. It is not a matter of improving the quality of the plaster, but one of speeding up a job of work by making it unnecessary to remove and replace scaffolding. The problem as it was put up to us did not involve the question of strength after setting. It was felt that lime plaster was strong enough after it was fully hardened, and that with its excellent sand-carrying capacity, workability, and cheapness it would be able to meet all competition if we could reduce the time of set. Our objective therefore was not a harder plaster but a quicker setting plaster. It may be desirable later to take up the problem of making a harder plaster also.

The work was outlined on an extremely broad and comprehensive manner designed to make available in the files of the National Lime Association specific data on all the possibilities that could be backed up by sound theory. We now have most of that data which will be published in detail in the proceedings of the National Lime Association, thereby making it available for ready reference by any member company who may be doing any work on this problem in the future. The work was carried on in accordance with the basic outline presented to the Association two years ago by President Warner.

We have extended that outline to its details as a practical working guide for laboratory operation. The details of this outline will be presented by Dr. Fink later on, but I want to call your attention here again to the four major lines of attack:

1. The use of admixtures with lime which in themselves have quicksetting properties such as portland cement.

2. The use of admixtures which may react with lime to produce a quick-setting product.

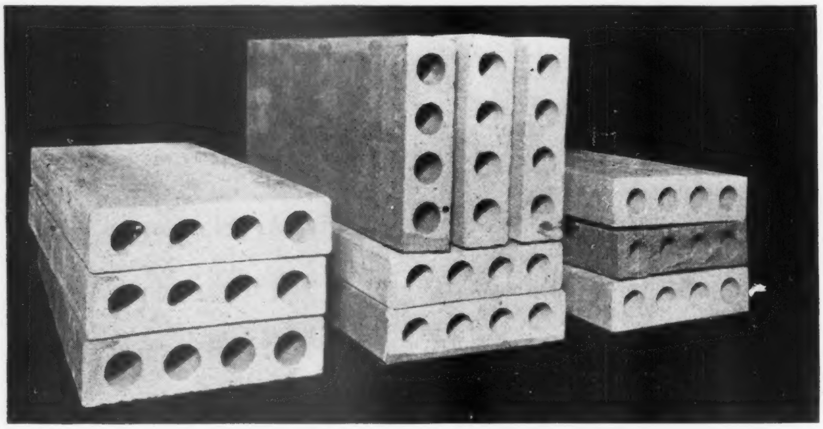
3. Variation and control of the burning conditions.

4. The introduction of carbon dioxide into the lime.

The quicksetting lime plaster problem is an old one which occupied the attention of the industry for a long time and will continue for some time to come. In this respect the status of the work at this time is both a disappointment and a surprise, but is not a discouragement. When we undertook this work it was with the quite firm conviction that it would result showing that you could not make a lime plaster that would set up in a few hours and that the best you could do would be to market a mixture with approximately equal parts of gypsum or portland cement which might enable the industry to hold on to this business a while longer.

The surprise lies in the fact that instead of the investigation showing that it can't be done, it has, in my opinion, indicated that there is good reason to think that by carrying on the investigation we will be able to develop a quick-setting lime plaster without the use of cement or gypsum that will hold its own in competition with the other materials. It is for the same reason that the work to date is not discouraging.

I wish to point out that we are taking out patents on developments in our own laboratory and fellowships as they come to look promising assigning all of them to the National Lime Association with provision for full use by member companies.



Partition blocks developed by the National Lime Association

Quarrying

A paper by Dr. Oliver Bowles, of the United States Bureau of Mines on recent development in quarrying for lime manufacture was really a supplement to the series now appearing in ROCK PRODUCTS and will be published in a subsequent issue.

Election of Officers

George B. Wood, president of the Rockland-Rockport Lime Corp., Rockland, Me., was elected president, as announced in ROCK PRODUCTS of June 16. Fred Witmer, secretary of the Ohio Hydrate and Supply Co., Woodville, Ohio, was elected vice-president and Milton McDermott of the Knoxville Sand and Lime Co., treasurer. Burton A. Ford, heretofore assistant general manager, was appointed acting secretary.

THE REGISTRATION

G. B. Arthur, Central Division, National Lime Association.

A. A. Alles, Schaffer-Alles Chemical Co., Pittsburgh, Pa.

Henry Angel, Kelly Island Lime and Transport Co., Cleveland, Ohio.

John Hull Amory, Sanitary Collapsible Barrel Co., New York City.

Joseph C. Aldous, Mississippi Lime and Material Co., Alton, Ill.

Arthur M. Brant, Ohio State University, National Lime Association.

Walter F. Beyer, Construction Engineer, Eastern Division, National Lime Association, Washington, D. C.

Charles C. Bye, Charles Warner Co., Wilmington, Del.

Charles A. Breskin, "Rock Products," Chicago, Ill.

Charles W. Brown, Sanitary Collapsible Barrel Co., New York City.

R. C. Brown, the Western Lime and Cement Co., Milwaukee.

C. G. Beling, Ohio Hydrate and Supply Co., Woodville, Ohio.

R. P. Brown, construction department, National Lime Association.

E. G. Baker, Ohio Hydrate and Supply Co., Woodville, Ohio.

F. C. Cheney, Allgood (Ala.) Cheney Lime Co.

Cornelius J. Curtin, Jr., Farnam Cheshire Lime Co., New York City.

J. H. Chiles, Austin White Lime Co., Austin, Texas.

Morgan Curtis, Northern Lime and Stone Co.

Henry M. Camp, National Lime Association, Eastern Division, Washington, D. C.

H. M. Coeyman, H. M. Coeyman Co., Newark, N. J.

William F. Campbell, Eastern Division, National Lime Association.

William E. Carmen, Riverton Lime Co., Riverton, Va.

C. W. S. Cobb, Glencoe Lime and Cement Co.

S. E. Cole, "Pit and Quarry," New York City.

L. A. Cover, Security Cement and Lime Co.

Fred A. Daboll, Charles Warner Co., Philadelphia.

O. L. Day, Harbison-Walker Co., Cleveland.

J. M. Deely, Connecticut Lime Co., Canaan, Conn.

H. Dittlinger, Dittlinger Lime Co., New Braunfels, Texas.

E. B. Dodge, Ohio Hydrate and Supply Co., Woodville, Ohio.

J. L. Faist, G. H. Faist, Woodville Lime Products Co., Toledo, Ohio.

G. J. Fink, National Lime Association office, Washington, D. C.

C. A. Franhenhoff, Celite Products Co., New York City.

J. J. Fitzgerald, "Pit & Quarry," Chicago.

R. S. Fetter, D. H. Stoll Co., Buffalo, N. Y.

William Flaherty, Hoosac Valley Lime Co., Inc., Adams, Mass.

W. A. Freret, Burton A. Ford, National Lime Association, Washington, D. C.

H. A. Gawthrop, Merion Lime and Stone Co., Norristown, Pa.

M. E. Holmes, National Lime Association.

Allen J. Huke, Rockland and Rockport Lime Corp.

B. K. Harris, Burton K. Harris Co., Lime Rock, R. I.

S. B. Kanowitz, Raymond Bros. Pulverizer Co., Chicago.

H. S. Kimberly, Peerless Film Co., Washington, D. C.

George P. LeGore, LeGore Lime Co.

A. H. Lauman, National Mortar and Supply Co., Pittsburgh, Pa.

M. R. Mathews, Marblehead Lime Co., Hollidaysburg, Pa.

C. C. Martin, Luckey Lime and Supply Co., Luckey, Ohio.

R. H. McElroy, International Clay Machinery Co., Dayton, Ohio.

Bernard L. McNulty, Marblehead Lime Co., Chicago.

Warner Moore, Moore Lime Co.

A. P. McCallie, Blue Diamond Process Co., Los Angeles, Calif.

William H. Moores, Moores Lime Co., Springfield, Ohio.

J. King McLanahan, Marblehead Lime Co., Hollidaysburg, Pa.

M. B. Mulvey, Tidewater Portland Cement Co.

Milton McDermott, Knoxville Sand and Lime Co., Knoxville, Tenn.

Richard McCoy, Powhatan Lime Co.

Hugh McDonald, Charles Warner Co., New York City.

G. J. Nicholson, White Marble Lime Co., Manistique, Mich.

A. Neustaedter, Roselle Park, N. J.

Lowell M. Palmer, Palmer Lime and Cement Co., New York City.

Edward B. Page, Rockland and Rockport Lime Corp., New York City.

R. C. Parker, Eastern Division, National Lime Association, Springfield, Mass.

Hilton E. Page, Abbey Co., Inc., New York City.

K. F. Pinnegar, F. M. Pinnegar, Kelley Island Lime and Transport Co., Cleveland.

J. F. Pollock, Ash Grove Lime and Portland Cement Co., Kansas City, Mo.

Nathan C. Rockwood, "Rock Products," Chicago, Ill.

Alan B. Sanger, "Rock Products," New York City.

J. E. Swan, Cleveland, Ohio.

C. C. Schmoeller, Mississippi Lime and Material Co., Alton, Ill.

W. D. Steward, National Lime Association, Chattanooga, Tenn.

W. F. Stolzenbach, National Mortar and Supply Co., Pittsburgh.

E. F. Schumacher, Celite Products Co., New York City.

J. C. Schaffer, Schaffer-Alles Chemical Co., Pittsburgh.

Edward C. Swessinger, Kelley Island Lime and Transport Co.

E. R. Stapleton, Tidewater Portland Cement Co.

J. A. Slipher, National Lime Association.

S. W. Stauffer, J. E. Baker Co., York, Pa.

T. B. Schertzer, Eastern Division, National Lime Association.

I. P. Tashof, Washington, D. C.

William. L. Urschel, G. C. Urschel, J. J. Urschel, Woodville Lime Products Co., Toledo.

O. J. Vanderpool, Palmer Lime and Cement Co., Toledo, Ohio.

N. L. Vernia, Hoosier Lime Co., Salem, Ind.

Fred Witmer, Ohio Hydrate and Supply Co., Woodville, Ohio.

G. B. Wood, Rockland and Rockport Lime Corp., Rockland, Maine.

James R. Withrow, Ohio State University, Columbus, Ohio.

H. E. Wiedeman, Hunkins-Willis Lime Co., St. Louis, Mo.

Charles Warner, Charles Warner Co., Wilmington, Del.

H. W. Nieman, Luckey Lime and Supply Co.

F. C. Mathers, Indiana University.

W. S. Steele, Kelley Island Lime and Transport Co., Cleveland, Ohio.

C. A. Cabell, National Lime Association.

E. E. Eakins, Irving Warner, Charles Warner Co.

W. C. Bird, Rockland and Rockport Lime Corp.

I. W. Stockett, Jr., National Lime Association.

F. W. Wilton, Steacy Wilson Co.

V. J. Azbe, St. Louis, Mo.

L. P. Dillon, Indian Rock Lime Co., Indian Rock, Va.

R. W. Riser.

R. B. Stiles, Merion Lime and Stone Co., Norristown, Pa.

C. M. Taylor, Massachusetts Institute of Technology, Boston, Mass.

B. F. Pease, Vermarco Lime Co.

Everett Wood.

Mr. Prendergast, New York City.

H. C. Cawley, Tomkins Bros.

Charles Wadsworth, "Chemical and Metallurgical Engineering," New York City.

A. C. Freeborn, Vermarco Lime Co.

N. Statham, New York City.

C. J. Hessey, Prest-O-Lite Co.

Thomas Robins, Jr., Robins Conveying Belt Co., New York City.

E. H. Grove, M. J. Grove Lime Co.

L. C. Barrick, S. W. Barrick & Sons.

G. A. Olsen, "Building Supply News."

Russell Rarey, Marble Cliff Quarries Co., Columbus, Ohio.

P. T. Coffey, W. R. Phillips, National Lime Association.

F. W. Kennedy, "Cement, Mill & Quarry," Chicago.

E. C. Porter, Vermarco Lime Co.

F. F. Pellet, Tobey Lime Co.
Oliver Bowles, W. E. Emley, United States Bureau of Mines, Washington.
R. T. Haslam, Massachusetts Institute of Technology, Boston.
Richard B. Stuba.
E. Sauminicht, International Clay Machinery Co., Dayton, Ohio.
James H. McNamara, John J. McInnis, Eagle Rock Lime Co.
Carleton H. Palmer.
Mr. Babcock.
Mr. Sheldon.
R. G. Griswold, A. E. Cameron, Twining Large Lime and Chemical Co.
J. L. Downer.

President Warner's Annual Report

SINCE I will definitely retire as your executive head with the close of this annual convention, it is with mixed feelings of regret and relief that I present this report.

You can all imagine the relief that one must feel in dropping the general responsibility that goes with the presidency of such an important organization as the National Lime Association, representing the welfare of approximately 100 lime manufacturers with capital investments exceeding thirty millions of dollars and annual sales exceeding twenty millions.

Your general welfare must always be the uppermost thought in the mind of your chief executive, otherwise he would fail in honestly striving for your advancement.

My regrets at retiring from the presidency cover quite a field. It is without doubt a high honor to be chosen and to serve in this position. It is a measure of the great esteem in which a member is held by his fellow members. I have at all times been deeply conscious of this regard and hope that, to at least a small degree, my service for the industry has merited it.

The work has been highly interesting, for the delving into the great variety of research problems touching upon the manufacture and use of lime products has been a form of exploration—in many cases in unknown scientific fields—which must always appeal to those seeking new light both for the monetary gains and the human welfare advantages which periodically reward such efforts. As is natural in such cases, much of our quest has been fruitless except for the fact that the work has definitely indicated that certain channels need not be explored again.

Blazing a way for our new-old industry has already uncovered much important scientific information and a reasonable proportion of this will gradually become available for commercial use of the industry. One hundred thousand dollars spent in research studies on a hundred detailed lines is amply justified if it uncovers one or two points which, when practically applied to our industry, will increase our annual production by one or two hundred thousand tons. With such untrodden fields as we have in the lime industry there is no question in my mind that the average results of our efforts in this particular direction will more than support the cost of our whole national budgets as the years roll by.

This annual convention will be brought up to date in executive sessions on the progress of your various research departments and the patent control we are developing to protect our members in the important fields uncovered by this work. I believe you will agree with me, when these reports are placed fully before you, that we members of the National Lime Association will have cause for gratification on the practical progress made during the past year.

During the past few years our efforts to mold an Association program fitted to the lime industry and meeting the best composite views of the membership have met with difficulties and changes. Not because we all have not been convinced of the necessity for associated effort in many of these lines and not because we have not been willing to spend the money in reasonable amounts for this purpose, but because there has been a considerable diversity of opinion as to the methods that should be pursued. I presume it is natural with 100 active, thinking members that we should experience this diversity.

Charles Warner, retiring president of the National Lime Association

As we review the past few years' history we can feel a satisfaction that we have, so far, composed and combined these views with partial success, though it has involved a swinging back and forth of the pendulum on practices that have been very disturbing. Yet out of these many changes we have gained experience and the sum total certainly marks progress.

I can sympathize with many of the views on both sides of a number of the important issues that we have confronted. There are strong arguments on both sides. Eventually from all of these experiences we will flux a National Association which will be the guiding spirit for the industry, though not necessarily a dominating influence. We may have to change its form several times again before it begins to settle down and function agreeably to such a large proportion of our membership that we can accept it as practically perfected to handle these particular problems of the lime industry. In the meantime we must be patient, charitable, and persistent in our faith in association effort.

For the past year, in addition to the gratifying developments of a practical nature in our research and patent department, we also must note the successful energizing field work in the Central and Southern sections. It is, however, unfortunate that in certain sections of the East the development of the field program has lagged. Out of this uncertainty further differences have arisen which call for our earnest consideration.

Recommendations will doubtless be made before the convention as to some changes and modifications planned to reconcile some of the objections which have been again raised to too much power or centralized control in the National Association. My own mind is quite open on this issue, *providing* that the principle is sustained that our National Association must be absolutely continued as the only body that can

(a) Efficiently and effectively work out the research and patent holding problems of the industry.

(b) Make the national contacts in a manner properly representing such an industry as ours with dignity and force.

(c) Serve as the guilding spirit in defining the general principles and policies which our Association should follow if we are to eventually serve our membership profitably and acceptably.

If this broad theory for building national success for lime manufacturers is accepted by the lime manufacturers, then we should not have so much trouble in applying the detailed relations between the national work and the division and district work. It does not mean dominating directing force running from the national to the districts as one extreme, but it does definitely mean that we must have a mutual understanding and respect for the functions that both the national and the district bodies have to perform and that these functions should be logically pursued and accepted by both divisions of the service in a mutually helpful manner.

The two big branches of the service are mutual. One cannot thrive or even survive for any length of time without the other. So my big appeal, in this my last official word to the Association, is:

Stick by the faith and carry on!

A Study of Lime Kilns

VI. Modifying Excessive Temperatures — Efficiency and Economy of Kilns

By Arthur E. Truesdell
Consulting Engineer, Pittsfield, Mass.

WE have seen that the temperature of the products of the combustion of coal on a grate runs much higher than that needed for the dissociation of calcium carbonate. The dissociation temperature is 900 deg. Cent. at atmospheric pressure, while the furnace temperature may be anywhere between 1200 and 1900 deg., depending on the furnace conditions. To obtain the lower temperatures essential for burning lime, some modification of the combustion is necessary.

As wood with its long flame and the accompanying large volume of gases mixed with steam from the fuel became scarce and high in price, the lime manufacturer tried to duplicate wood burning by the use of the various expedients mentioned in the preceding article, or fell back on producer gas with its low calorific power.

The methods of dilution of the gases generally practiced delayed the intimate mixture of fuel and oxygen, producing more or less flame and increased the volume of the products of combustion with a lowering of their temperature.

These methods have been fairly satisfactory on the whole in the production of lime. Possibly producer gas has given the better results as to quality of the lime and the dilution methods as to quantity produced. But in these later days of increasing prices of fuel, we must examine also the heating efficiency. Are we using the best methods of heating and do we get complete combustion with no waste of fuel or air? While few analyses of the waste kiln-gases of commercial lime kilns have been made, we know that as a rule they show waste of fuel in smoke and ash, and as the fuel is burned on a grate, we may assume that considerable excess air is being used. Often on short vertical kilns, combustible gases reach the top and are seen to burn in the air. These losses apply in varying degree to wood burning as well as to the modified combustion of coal.

Evidently the reason that we get these losses is because the intimate mixture of fuel and oxygen does not occur, or, when it does, the temperature has fallen below the ignition point. As the flaming gases pass through the kiln they give up their sensible heat to the limestone and soon their temperature drops so low that combustion ceases. Smoke and excess air pass from the kiln, especially at such times as the kiln is cold or newly filled with stone. We also find intimate mixture interfered with whenever the combustion is delayed and dragged out through or over the limestone, because the combustible gases become diluted with the carbon dioxide coming from the stone. This adds to the previous trouble and makes doubly sure the loss. We must conclude, then, that to be efficient there is a limit to a flaming combustion.

The troubles mentioned occur in most of the kinds of lime kilns using a long flame and are sure to occur if such kilns have a small combustion space. At first sight it would seem that much heat could be captured by the limestone in utilizing the heat radiated from a long flame playing between the stones in the heating chamber. As a matter of fact, such a flame becomes shortened for two reasons in addition to those given above: First, the eddies made by the stones in the gas currents hasten the mixture of the combustible gases and air in each streamlet; second, the gases while passing through are shut off by the stones from wholesale mixing with the other streamlets. The first of these effects, while giving more efficient combustion, tends to localize the heating, which we do not care for. Evidently, then, from an efficiency standpoint, delayed or flaming combustion leaves something to be desired, especially in cases where the flame impinges directly on the stone.

It is possible that in kilns where the raw material must not be overheated, better results may be had in the combustion of coal and other fuels giving a high temperature when burned efficiently by depending more on heating by conduction, since heating by radiation is not nearly as efficient in many cases as was supposed, besides being liable to injure the product. The writer is hoping for some progress in the solution of this problem through a method on which he is working for burning the fuels under the most favorable conditions for complete combustion and then cooling the products of combustion to the temperature most suitable for the limestone.

Draft Necessary in Heating Chamber

The carbon dioxide coming from the stone during dissociation should be promptly removed, as the gas pressures have a vital influence on the process of dissociation, which we have already noted. When released this gas is at a lower temperature than the other gases present, and consequently heavier. Suction fans are a decided benefit to most forms of lime kilns, as thereby draft can be easily maintained at reduced gas pressures.

Heating Requirements of Lime Kilns

To illustrate how the efficiency figures are found and to bring out one or two new features in lime burning, we will go through a typical calculation of the heat balance of an ordinary vertical kiln with outside furnaces, burning wood. This will give us also an idea of the relative importance of the various heat losses in the vertical kiln, although its operation with wood is somewhat obsolete. For data we take:

Limestone; analyzing	Per cent
Calcium carbonate, $CaCO_3$	95.00
Magnesium carbonate, $MgCO_3$	2.00
Silica, SiO_2 } Alumina, Al_2O_3 }	2.00
Iron oxide, Fe_2O_3	.....
Moisture, H_2O	1.00
	100.00

Fuel; hardwood—air dried—25 per cent moisture, analyzing	Per cent
Carbon, C	37.5
Hydrogen, H	4.5
Oxygen, O	31.5
Nitrogen, N and ash	1.5
Water, H_2O	25.0
	100.0

Weight of 1 cord = 3700 lb. = 1680 kg.
Consumption, per ton of lime = ½ cord
Consumption, per kg. of lime = 923 kg.

Temperatures
Outside air .... 20 deg. Cent. = 68 deg. F.
Drawn lime on hearth ....500 deg. Cent. = 932 deg. F.
Waste gases ......250 deg. Cent. = 482 deg. F.

Lime output per 24 hours=20,000 lb.= 9091 kg. The silica, alumina and iron will remain in the lime. The moisture will be driven off.

As $CaCO_3$ contains 56% CaO and the stone is 95% $CaCO_3$, 100 kg. of stone will produce [See equation (1), ROCK PRODUCTS, May 5, 1923, p. ——].

$$100 \times 0.95 \times 0.56 = 53.2 \text{ kg. of CaO}$$

Likewise, as $MgCO_3$ contains 48% of MgO, there will be from the same 100 kg. of stone

$$100 \times 0.02 \times 0.48 = 1.0 \text{ kg. of MgO}$$

Then, in burning 100 kilograms of this

limestone to lime, we obtain the following:

	Kilograms	Per cent
CaO	53.2	94.7
MgO	1.0	1.8
Al_2O_3 and SiO_2	2.0	3.5
Fe_2O_3	....	....
Moisture	....	....
	56.2	100.0

The weight of limestone needed to produce 1000 kg. of this lime is

1000/56.2x100=1779 kilograms

and the weight of the substances in this 1779 kilograms of limestone are

		Kilograms
$CaCO_3$	1779x0.95 =	1690
$MgCO_3$	1779x0.02 =	36
Al_2O_3 and SiO_2	1779x0.02 =	36
H_2O	1779x0.01 =	17
		1779

Air—Assuming that excess air is used to the amount of 75%, and that 20% of the carbon in the fuel is incompletely burned to CO, we find per kilogram of wood burned that

	Kilograms
Oxygen supplied	= 1.653
Nitrogen accomp.	= 5.510
Air supplied	= 7.163

Volume of air supplied = 5.54 cu. meters (std. cond.) = 5.94 cu. meters 20 deg. Cent.

Combustion—The heating value per kilogram of wood burned by Dulong's method gives

	Calories
Carbon to CO_2	2430
Carbon to CO	182
Hydrogen to H_2O	193
	2805
Moisture in wood absorbs	397
Available heat	2408

Temperature of the products of combustion = 1014 deg. Cent.

Waste Gases—These figure out per kilogram of wood burned

			Per cent
CO_2 from combustion	1.100 kg.	= 0.973 cu. m.	14.3
CO_2 from stone	0.827 kg		
CO from combustion	0.175 kg.	= 0.139 cu. m.	2.1
H_2O and moisture	0.655 kg.	= 0.809 cu. m.	11.9
O_2	0.708 kg.	= 0.492 cu. m.	7.3
N_2	5.510 kg.	= 4.373 cu. m.	64.4
Total waste gases		6.786 cu. m.	100.0

Volume of waste gases at 250 deg. Cent. = 13.0 cu. m.

Heat Units—		Calories
Heat available per 1000 kg. of lime is 923x2408	=	2,222,500
Heat lost in imperfect combustion 923x425	=	392,300
Heat for driving out moisture in stone (detail omitted)	=	10,900
Heat for dissociating $CaCO_3$ 1690x451.5	=	762,300
Heat for dissociating $MgCO_3$ 36x348.8	=	12,500
Heat lost in hot lime 1000x0.20x(500-20)	=	96,000
Heat lost in hot waste gases (detail omitted)	=	524,000
Heat lost while drawing the kiln by which the temperatures in the kiln are reduced 100 deg. Cent. on the average, 4 times per day (detail omitted)	=	337,000

Heat Balance of the Kiln

Dr.		Calories	Per cent
Calorific power of the fuel	=	2,614,800	115.0
Deducted for inefficient combustion	=	392,300	15.0
Available calorific power	=	2,222,500	100.0
Cr.			
Dissociating calcium carbonate	=	762,300	34.2
Dissociating magnesium	=	12,500	0.7
Driving out moisture	=	10,900	0.5
Total useful heat	=	785,700	35.4
Heat carried out in lime	=	96,000	4.3
Heat carried out in waste gases	=	524,000	23.6
Heat carried out in dust	=	....	....
Heat carried out while drawing	=	337,000	15.1
Radiation, etc., to balance	=	479,800	21.6
Total wasted heat	=	1,436,800	64.6
	=	2,222,500	100.0

Heat Losses in Dollars

Translating the heat units into dollars and cents will give us a better understanding of the above figures; so let us do so on the basis of air-dried wood in the furnace costing $7 per cord.

Consumption of wood per day 9091 x 923/1000 = 8391 kg. = (8391/1680) = 5 cords

Cost of wood per day = $7.00 x 5 = $35.00

		Per cent		
Useful heat		35.4		= 12.39
Wasted heat	In lime	4.3	= $1.51	= 22.61
	Waste gases	23.6	= 8.26	
	Dust	....		
	Drawing air	15.1	= 5.29	
	Radiation, etc.	21.6	= 7.56	
		100.00		$35.00

It will never be possible to spend but $12.39 for fuel, where this kiln requires $35, but several of the heat wastes can be reduced materially.

In vertical kilns having mixed feed the heat in the lime is recovered by the draft of cooler air rising through the lime to the hot zone. Recovery of this heat is a leading feature of the horizontal kilns, both of ring and tunnel type. Rotary kilns employ coolers which recover some of the heat and radiate some of it. The vertical kiln with outside furnaces should have their drawing cones provided with means for cooling the lime inside by drawing the air for combustion through ducts about the cone, thus recovering some of this heat. The Shoop patent on this feature has expired.

We cannot do away with the waste gases; but we can keep their temperature low and their quantity at the minimum. In the example above the waste gases contain 3.54 kg. of excess air for each kilogram of fuel burned. This air passes through the furnace and kiln, and in doing so is raised in temperature 230 (250-20) deg. The heat per 1000 kg. of lime thus carried away is (details omitted) 179,000 calories; equal to 34.1 per cent of the total heat in the waste gases. It is not probable that the furnaces could be run with no excess air; but if so, the saving would be $2.82 per day, 80 per cent of which modern methods of combustion would save.

The heat lost by draft of cold air through the kiln when drawing is largely unnecessary as covers could be placed over the top to be closed at such times. The tenders would need special equipment for protection, as the poking of the kiln would be more disagreeable. This loss occurs, of course, only in vertical kilns with outside furnaces.

Radiation is generally accountable for a large amount of waste heat (through the walls of the kilns). Horizontal types are often well insulated, but vertical and rotary kilns have been poorly built in this respect. Walls should be built thicker. Insulating brick are coming into use for backing the hot zones and are more than making good.

Mention should be made here of the loss due to incomplete combustion and fuel unconsumed in the ash. The latter is negligible with wood but with coal is material. We have assumed incomplete combustion of carbon to CO to amount to 15 per cent of the heating power of the fuel, being caused by poor mixture of fuel and air in a poorly designed furnace. This loss amounts to $1.05 per day—about half the cost of the heat for dissociation.

In passing, it is interesting to note that in the example, 43 per cent of the carbon dioxide in the waste gases came from the

stone. With perfect combustion this figure would be 38 per cent.

Wood vs. Coal

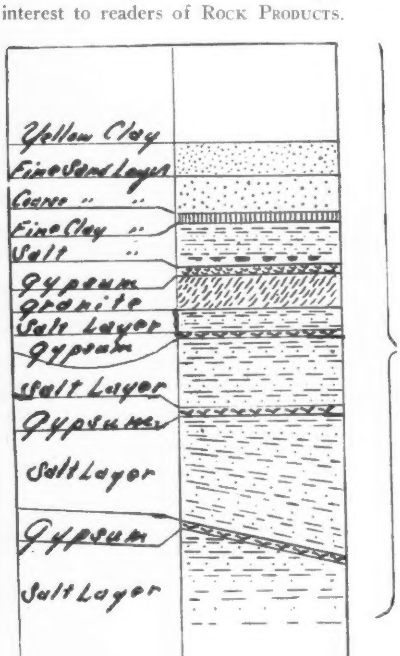
In comparing these figures with those previously given as illustrating the combustion of coal, we should note the difference in the calories per kilogram of fuel; 7083 for coal, 2408 for wood. The energy density (if one can use the term) being three times as great in coal than in wood. This corresponds to about the same as the specific weights. More important are the temperatures of the products of combustion in the two cases. Coal giving 1920 deg. Cent.; wood, 1014 deg. Above the dissociation temperature for calcium carbonate, the products from coal reach 1000 deg.; from wood but 100 deg. This explains why unmodified coal burning in vertical kilns with outside furnaces is not a success for lime and is the reason why we selected wood burning in the illustration given, thus bringing out the characteristics of the two fuels.

(To be continued)

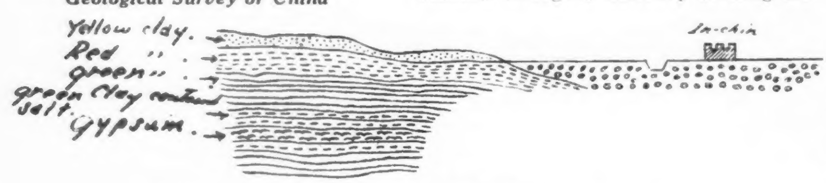
Production of Gypsum and Its Uses in China

By M. H. Chou
Sales-Manager of the Ta Hu Cement Co. Shanghai

HOW gypsum is produced and to what uses it is put in China should prove of interest to readers of ROCK PRODUCTS.



Geological formation as shown by the Geological Survey of China



Geological formation as occurring in the San Tan mine

1. *Mining of Gypsum*—Gypsum, called Shih-kou in Chinese, has been used by the Chinese as cementing material for construction purposes for more than several thousand years. It was mined by natives in a very primitive fashion. As it usually occurs associated with salt layers in the ground, therefore it is prepared by boiling the impure gypsum mineral in a big kettle. The solution is evaporated for recovery of salt; the residue is impure gypsum. The latter is further purified by dissolving in hot water.

2. *Geological Occurrence*—There are two places in China noted for the production of gypsum, namely, In-chin, of Hupeh province, and San Tan, of the Hunan province. Small quantities of gypsum are also produced in the following places: Ping Luh Yuen, of the Shansi province; Shin Yuen, of the Honan; Keui Chi Yuen, of the Anhui province; Van Weu of Szecheun province.

In-chin is located about 100 li from the Shan Ki station of the Hankow-Peking Railway. The gypsum mine is situated about 10 to 15 li northwest of the In-chin district. The mine spreads over a distance of from 30 to 40 li. Gypsum is imbedded between the layers of sandstone and salt. The thickness of the gypsum layer is about 2 ft. 6 in. This layer further consists of several layers of salt. A private company was established to mine the gypsum. The annual production is from $700,000 to $800,000 of salt and $600,000 of gypsum.

The product can be directly shipped to Hankow through a waterway covering the distance of 300 li. The annual shipment of gypsum to Hankow reaches 400,000 piculs (100 catties—133⅓ lb.).

According to the report of the Geological Survey of China, gypsum occurs in the formation shown in the accompanying diagram.

In the San Tan the mine covers a distance of several hundred li and was discovered about 40 years ago and has been mined by a private company. Its geological occurrence is shown in the accompanying diagram as reported by the Geological Survey of China.

3. *Sale of Gypsum*—The mining company sells gypsum to the brokers, who ship it to Shanghai, Canton, Hongkong, Tientsin, and other places of commercial importance and is then resold to those metal dealers from whom the consumers usually buy in quantity for their own use.

4. *Uses of Gypsum*—Chinese gypsum is extensively used as the material to retard the setting time of cement in those cement companies such as Chee Hsin Cement Co. and the Green Island Cement Co.

To some considerable extent gypsum is used as the material for binding glass to the window. The farmers use gypsum to a certain extent, but not as extensively as lime, to do away with the acidity of the farm soil. Gypsum is also used as a coagulating agent for making bean cake, which is consumed quite extensively.

5. *Chemical Composition of Gypsum*—Gypsum as sent from the mine gives the following analysis:

	Per Cent
CaO	32.53
SO_3	46.04
H_2O	20.97
MgO	None

Effect of Immigration Cut on Industry

IMMIGRATION statistics for 1922 with relation to the 3 per cent restriction law, while showing that "unquestionably the law greatly reduced the volume of immigration," do not afford a certain basis for estimating the future effect of the act on the industrial labor situation, according to a recent report of the Civic Development Department of the Chamber of Commerce of the United States.

The survey was the basis of the report of the Immigration Committee of the National Chamber, recently made public, and which recommended retention of the 3 per cent restrictions, coupled with an additional 2 per cent quota allowance in case of demonstrated need to be employed in making a practical test of selective restriction methods. Action by the National Chamber on the committee report is expected during the annual meeting of that body in New York this month.

The survey showed that in 1922 (fiscal year), the first year in which the 3 per cent law was operative, excess of aliens admitted over aliens departed was 87,121, as compared to 552,132 in 1921, and 769,276 for the last comparable pre-war year, 1914.

The Design of Sand Plants

Part II, No. 3. Describing Various Flow Sheets of Plants to be Used in Washing Material That Is Dug from Dry Deposits and the Making of Artificial Sand by Crushing Gravel

By Edmund Shaw
Consulting Engineer, Chicago

SO FAR, these articles have dealt principally with the washing plants fed from sand dredges, as by far the greater number of the straight sand plants of the country are of this type. But in closing the series something should be said about the sand plants which are connected with dry-land deposits.

As has been often pointed out in these papers, the design of any washing plant is largely affected by the method employed to mine or dig the raw material. It has been said that "washing begins at the bank," and this is just as true of those mining methods in which no water is employed as it is true of dredging or hydraulicking.

Stripping Not Always Economical

The matter of stripping the deposit of its top soil is one of the first to be considered in working a dry deposit. Stripping is often practiced where it would be cheaper to dig the top soil with the sand and wash out the clay and loam. The question of whether to strip depends on the water supply available, the depth of top soil as compared with the depth of sand below it, and the cost of the stripping operation.

Knowing these three things, it would seem a matter of simple calculation to determine whether stripping would pay. But there are cases where other matters than the immediate operating cost should be the determining factor.

In one such case which the writer has in mind, it was shown that the cost of the entire operation was 26½ cents per ton for washed sand on the car. Careful figuring showed that this figure could be reduced to 25 cents per ton if stripping was not practiced, and that there might even be a further profit than the 1½ cents differential, as some sand might be recovered which had previously been lost in stripping.

But it was decided not to change the method of operating for the excellent reason that if the deposit was not stripped before being mined and washed there would be much more residue to dispose of, and there was none too much space available for its disposal. Furthermore, the plant would have to be crowded to get through the extra material, and these things outweighed a promised profit of 1½ cents per ton.

On the other hand, one has seen stripping practiced where there was rarely more than a foot of top soil above some 20 to 30 ft. of sand. The little clay and loam which this top soil contained would have been taken out by the ordinary washing operation, and the plant would not have noticed the difference.

Use of the Inclined Belt Conveyor

The problem in designing a washing plant for material that is dug dry is largely one of elevating the material to the head of the washer. What might be called the standard method of getting the material to this point, and that which is employed in so many large sand and gravel plants, is the use of an inclined belt conveyor. But this machine costs considerable money and on small operations where only sand is to be washed a cheaper means may be employed.

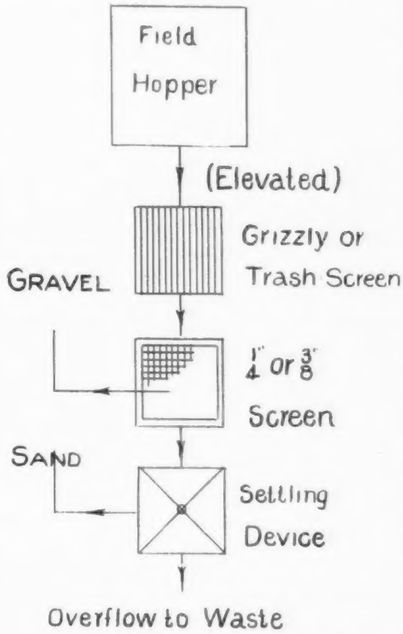


Fig. 4. Flow sheet showing two classifications—gravel and sand

One quite successful plant has employed a pump to secure this elevation. The manager reasoned that since he had to pump the water as well as elevate the sand, he might as well combine the operations and do the work with one machine. The sand was dug with a dragline scraper bucket and drawn to a point above a 6-in. pump where it formed a small stockpile. A stream of water under pressure played on this pile and washed the sand down into a little basin in which was the suction of the pump. A large screen, or grating, kept back the largest pieces. The pump sent everything that passed through this grating to a screen, which took out the trash and the small amount of gravel that was found with the sand, the water and sand going from this screen to a settling box of ordinary design. This arrangement worked pretty well and it had the advantage of keeping the digging and the washing independent, for the material could be accumulated in the stockpile if for any reason the washing could not go on.

Hydraulic Elevator in Place of Pump

Where water under pressure may be cheaply obtained, a hydraulic (jet) elevator may take the place of the pump, and this has the advantage of being a very good scrubber. The writer has heard of a small plant, intented to supply a road contract, which was designed in this way. All that was needed for this plant was: A pressure pump for the water, a jet elevator, a gravity screen, and an automatic settling tank. It was intended to use a portion of the overflow water to sluice the sand to the jet elevator. There is no reason why such a plant could not be made to serve in small operations, where only a single product, concrete sand, was to be produced.

Power Scraper Is Growing in Favor

In all of the installations spoken of, the power scraper with bottomless bucket has been the machine employed for digging the sand. This device is growing in favor in sand and gravel operations, and it is especially adapted to sand operations where the digging strains are comparatively light. But it demands a method of lifting the sand from the ground level to the head of the plant, as it cannot dump directly into a bin

as the standard elevated cableway dragline does.

A prominent firm of manufacturers of this scraper bucket has designed several sand plants to be used with it and has placed a bucket and belt elevator to take the sand from a trap or small storage bin which is filled by the scraper bucket. The elevator is somewhat cheaper to construct than the belt conveyor which has been spoken of as the standard machine to get this elevation and, properly designed, it is almost as satisfactory where only sand is to be handled.

Elevated Cableway Dragline

The elevated cableway dragline, or tower excavator, as it is sometimes called, is sometimes employed in sand operations, and is especially adapted to those deposits which lie partly under water and where the depth of the water is not sufficient for dredging. Also, these machines are better adapted to smaller and less regular operations than dredges, and for deposits that go to great depths. They have the same advantage a dredge has in that the same machine mines and transports the crude material to the

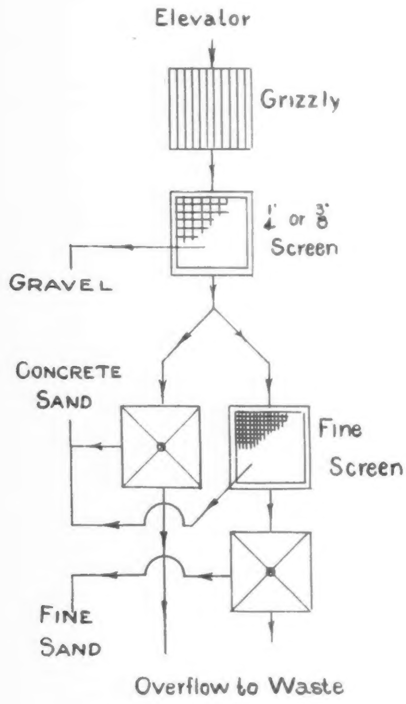


Fig. 5. Flow sheet showing three classifications—gravel, concrete sand, and fine sand

plant and elevates it to the head of the plant.

A full list of all the machines used for digging in sand deposits would include about every sort of excavating device in use. One has noted dragline excavators, dry land dredges, equipped with both orange-peel and clamshell buckets, steam shovels, locomotive cranes with excavating buckets, and even a guyed wooden derrick, with a bucket of the excavating type.

Locomotive Crane as an Elevator

In at least two plants of which the writer knows, the locomotive crane is successfully employed as an elevator. The sand is brought to the crane by a scraper bucket and then lifted to a hopper by the crane. The capacity of the crane is greater than that of the plant, so the crane operator can fill the hopper and then use the crane for other work, such as stock-piling or switching cars.

Washington Plant for Dry Dug Material

The plant for washing the dry dug material may be as simple or as complex as the number of products to be made shall determine. The simplest plant of the sort is that which makes only a single product—building sand. The flow sheet is shown in Fig. 4. Only the necessary units are included. The grizzly is necessary to take out roots and sticks and the occasional large rock that is found in all deposits. The gravel screen insures that only sand will be settled in the settling device. In most straight sand plants the gravel amounts to so little that it hardly pays to save it, but there is always a market at some price for a mixed product and in many plants it has to be sold to keep it from accumulating.

Fig. 5 shows a flow sheet for two products, concrete sand and finer sand, used for plastering or perhaps for core sand or other industrial uses. The separation is made in this case by a screen, and a simple gravity screen will usually do all that is required. Both the undersize and the oversize are saved, the former being the fine sand product and the latter being added to the concrete sand, which is usually improved by the addition of the coarser particles. The precious stuff in concrete sand is the material composed of grains between ⅛ and ⅜ in., according to one authority who has given years to study of the subject. Most concrete sands are therefore improved by taking out the fine sand in the way that is shown in the figure. If the fine sand can be marketed, there is no loss.

The watching and cleaning of a fine gravity screen such as is shown here is a nuisance, and it may be avoided by the installation of a mechanically or electrically operated screen. But in the smaller operations the attendant who looks after the rest of the plant can find plenty of time to clean the screen as this is required.

Classification Preferable to Screening

Classification might better be employed than screening to make this split if the fine sand is fine enough for the employment of this process. For making plaster sands with grains of ⅛ in. and coarser perhaps, it is not so well adapted, as most natural sands contain flat, scaly pieces which are bound to go into the overflow product.

Classification is preferable to screening in the next step, which is separating very fine sand, to be used as asphalt sand if it contains a sufficient proportion of minus 80 mesh grains, or for core sand or other industrial purpose sand if it does not. In this case the flow sheet is changed by making the settling devices classifiers and sending the overflow to a settling box which will settle out the finest sand. In such a plant it is supposed that all the sand will be put into marketable products, and that only clay and the finest silt will escape with the over-

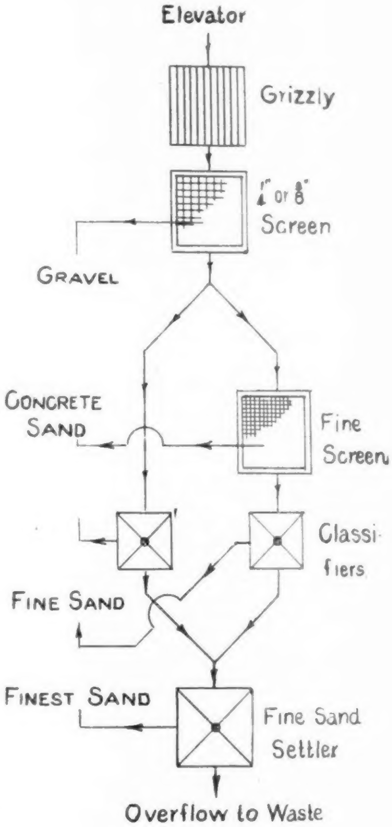


Fig. 6. Flow sheet showing four classifications—gravel, concrete sand, fine sand, and finest sand

flow. The flow sheet of such a plant is given in Fig. 6.

Plants which produce the special sands, such as filter sand and blast sand, invariably take the unsized sand drained, after it has been thoroughly washed to remove the clay. This brings them into the class of plants now being discussed.

Making Special Sands

The making of these sands is a matter of very careful separation, since the specifications under which they are sold are rigid and the sand is always carefully tested and inspected. For making these sands, both hydraulic methods and screening are used. Screens are used in the greater number of plants, but the writer feels quite certain

that hydraulic methods could better be used in making the smaller sized products.

The devices used for making these sands by hydraulic methods have been discussed in the previous numbers of this series. The plant layout, or flow sheet, is almost always of the straight line type, the crude material passing from one machine to the next.

The settling devices shown in the flow sheets may be simple settling bins, automatic discharge settlers, or devices employing mechanical excavators, drag belts, or drag chains, to bring out the washed sand. The latter sort of settlers are particularly adapted to sand that is dug dry. The water in the plant may be controlled so that the settlers may be run with less water than is used in dredging; such devices do not often have sufficient area to handle the heavy flow of water that accompanies a dredge discharge. They have the advantage of giving a dryer product than the automatic discharge settlers, but they cost more to operate. Some forms are good classifiers as well as good dewaterers.

Producing Artificial Sands

A problem which is of the liveliest interest to sand producers in certain states is that of producing artificial sand by crushing the gravel found with the sand in the deposit. The market for gravel in these states is limited on account of the specifications for highway material and the sand alone shows a profit. Sometimes the gravel accumulates about the plant to an inconvenient degree before it can be sold at all.

Different machines have been tried out for the work of crushing and practice has not settled on any one of them as the best. The same is true in mining work, to a certain degree, although for ore-crushing down to about ¼ in. the roll may be considered the standard machine.

The Rolls or Crushers

The writer's experience with rolls is that they are excellent machines within the limits of their reduction ratio, and provided they are in charge of a man who knows how to operate them. The reduction ratio—which means the ratio between the largest piece in the feed and the largest piece in the crushed product—is low. It is generally stated to be 4 to 1, which means that if the product is all to pass through a ¼-in. screen, the largest pieces in the feed should not be more than 1 in. in diameter. As gravel has 2-in. pieces and larger, the roll is not adapted to crush it into sand unless it is used in series with some other machine, and rolls are invariably used following a rock crusher of the jaw or gyratory type, or a coarse roll, where they have to break to such a fine size.

It is something of an art to keep roll shells in good condition, which means running them so that they will not corrugate or develop flanges at the edges. "Fleeting," or setting, the roll first to one side and then to the other of its companion is one means of doing this, and careful regulation of the feed to see that the roll is crushing evenly all across the face is another. If a shell does get out of true, there are devices for turning it off in place or grinding it off with emery blocks. A good operator will wear down a roll shell almost to the thinness of paper before discarding it.

But this demands more care and attention than can be given to machinery around a sand plant, and this fact, combined with the low reduction ratio, practically puts it out of the running as a sand making machine. Exception must be taken to this in the case of large plants, where the production is so great that skilled labor to take proper care of the rolls can be afforded and where the arrangements for repairing them and changing shells are of the best. It may be that the business of making artificial sand will grow to such an extent that it will pay to install large, well-designed plants employing rock crushers and rolls of large and heavy construction in order to make it.

Disc Crushers

Disc crushers, of both the vertical and horizontal type, have largely taken the place of rolls in crushing rock and ore and are today perhaps employed more than any other machine in the production of artificial sand. They have a high record for efficiency, although some operators have found the maintainance cost rather high. The vertical type of disc crusher is an especially good machine, having a high capacity and giving an excellent product. If any machine *is* standard for this work, it is the disc crusher. In the last two or three years large installations of these machines have been made, batteries of as many as 20 machines being used in some plants.

Meanwhile, the manufacturers of both jaw and gyratory crushers have been modifying their standard machines to meet the conditions of artificial sandmaking. One jaw crusher which has met with considerable success in this work has a long and shallow opening with jaw plates to correspond. One standard size of this machine uses an 8x24-in. jaw plate. This gives a high capacity on small-sized feed, breaking down from 2-in. pieces to ⅜-in. or even ¼-in. Another type of jaw crusher which has been developed for sandmaking is really two crushers in series on the same bed plate.

Special Gyratory Crushers

Special gyratory crushers are beginning to be used for the work, the design being such that the machine will have a fairly high reduction ratio and large enough opening to accommodate a considerable flow of feed.

Rock crushers, both jaw and gyratory, have a high crushing ratio, about 7 or 8 to 1. They are simple and any one can run and repair them, but they have the same defect as has been noted in discussing the work of rolls: They are likely to wear more in one part than another, leaving an opening through which too large pieces will pass.

Inventors and designers of machines are constantly at work on the problem, and new machines for doing this kind of work are being placed on the market every day. It is possible that the best machine for making artificial sand and doing similar work (for other industries than sand and gravel have the same problem) is yet to be the work of the inventor.

If such is the case, it is quite possible that the new machine will be on the principle of the ball and tube mill. The simplicity of this type of machine, its ability to take any size of feed, and the fact that the steel worn off in crushing may be replaced daily, by merely adding more balls to the load, give it advantages over all other types of fine crushing machines. In its present form it is essentially a fine grinding machine, but experiments are going on which indicate that it may perhaps be given a form which will adapt this machine to coarser work, such as the production of artificial sand.

(Concluded)

Use of Lime in Canadian Agriculture

A BULLETIN, "Lime in Agriculture," has been prepared by Dr. F. T. Schutt, chemist of the dominion of Canada, in response to many inquiries from Canadian farmers respecting the application of lime and the relative merits of lime, ground limestone and other related substances.

Dr. Schutt points out that there is a use and misuse of lime and that, unless rationally employed, the immediate advantages may be followed by decreased yields due to soil impoverishment. On the other hand, lime and carbonate of lime, if correctly used, are of much benefit, increasing crop production without impairing the soil's fertility.

The author states that the exclusive and excessive use of the more caustic forms (quick and slaked lime) must inevitably lead to exhaustion of fertility, as they act as stimulants, setting free, but not adding to, the soil's store of plant food.

A Correction

IN the article published in the May 19 issue of ROCK PRODUCTS, describing the Dixie Portland Cement Co.'s new crushing plant at Richard City, Tenn., the main conveyor is fed by a 36-in. Magnetic Mfg. Co. magnetic pulley instead of a Cutler-Hammer pulley.

This error is due to the fact that when a ROCK PRODUCTS editor visited the operation the pulley had not arrived and he was misinformed of the fact.

Cement Manufacturers Ask More Uniform Distribution of Product

If Means of Relief Are Made Effective, the Amount Available for Construction Purposes Will Be Increased. The Associated Contractors Present Their Side of the Situation

OFFICIALS of six representative portland cement companies signed the following letter addressed to Secretary Hoover, under date of April 9, 1923. These companies were:

The Atlas Portland Cement Co., by Lowell R. Burch, vice-president; Hercules Cement Corp., by Morris Kink, president; Penn Allen Cement Co., by W. E. Erdell, president; Dexter Portland Cement Co., by Joseph Brobston, vice-president; Lehigh Portland Cement Co., by E. M. Young, vice-president; Alpha Portland Cement Co., by G. S. Brown, president.

In the desire to provide the cement necessary to meet the requirements of this year's unprecedented demand, we call to your attention a condition of uncertainty in the industry due to heavily over-estimated or duplicated contracts for future delivery. If some means of relief can be made effective, the amount of cement available for construction purposes will be materially increased.

In order that an architect, a contractor or an engineer may be able to know the exact cost of the cement required for a particular enterprise—it is a trade practice to enter into a contract technically known as a "specific job contract," under the terms of which the manufacturer agrees to deliver the cement required during the entire construction period of the project at an agreed price. This practice involves the manufacturer in a hazard as to manufacturing cost, because during the life of the contract the factors entering into the cost may materially advance. The terms of these contracts confine deliveries to the requirements of the job and are so made in order to minimize speculation in cement to the detriment of the public.

Desire to Speculate at Manufacturer's Expense

It is a common practice for purchasers—either through excessive caution or desire to speculate at the manufacturer's expense—to make padded contracts naming amounts much in excess of the requirements of the job and even to place duplicate contracts for the requirements of the same job with several different manufacturers. This is the serious problem. It introduces an element of uncertainty into the manufacturer's knowledge of his exact position. Basing his judgment on specific job contracts booked, he figures the amount of his production which is still available for sale. But if the contract for cement has been placed with several companies, only one may be called upon for delivery, which means that the other companies have withdrawn from the market the amount of cement for that job, which, if the duplication of contract had not occurred, would be available for sale.

In the year 1920 an investigation was conducted for the purpose of determining, so far as possible, the average amount of cement over-contracted for on specific jobs. Capable engineers were employed to make the estimates. The investigation showed that 40 per cent of the cement so contracted for was not required for the jobs.

Demand for building materials this year has aggravated the conditions herewith described, and there is no doubt of an outstanding duplication or padding of contracts running into many millions of barrels that will not be called for delivery, which are now necessarily withheld from the market because of these fictitious contracts. If it was possible to eliminate them, this additional amount of cement would be available for sale, and would be a material influence in making the cement market easier.

Peak-Load Condition an Important Factor

Another factor of importance is the peak-load condition which occurs during the months when outdoor construction is most active and the demand for cement heaviest. If consumers would realize that spreading their purchases over the months of normally low demand not only would assure an ample supply but also better delivery, it would be a great help to all concerned. Otherwise the manufacturers are called upon to deliver in the peak months of July, August, September and October more cement than it currently produced or can be currently delivered.

Realizing that this year would require cement exceeding in amount that of any previous year, cement manufacturers have increased their output beyond that of any in their history, notwithstanding the fact that last year's production and shipments exceeded all previous records. For the months of January and February, 1923, the output was 16,789,000 bbl. against 8,569,000 for the same months of the previous year, an increase of 8,220,000 bbl., or 95 per cent. At the same time, stocks on hand increased, 2,122,000 bbl. having been added in February. Stocks at the end of that month were 14,142,000 bbl. Also stocks of clinker at mills increased over 500,000 bbl.

Conservative estimates indicate that production this year may reach 120,000,000 or 125,000,000 bbl. However, the estimated capacity of the mills of the country leaves a large margin of excess, and there is no valid reason for assuming that there will be an actual shortage of cement in 1923 if transportation facilities permit of prompt deliveries.

The peak price for cement was reached in 1920 when the average price at the mills for the entire year was $2.02 (figures from U. S. Geological Survey). In 1921 the price declined to $1.89, and for the year 1922 there was a still further decline in the average price for all mills of the United States to $1.76, or a total decline of 26 cents per barrel.

Wasteful Methods Must be Abandoned

In presenting this situation, we are mindful of your great interest in aiding to prevent a cessation of construction and in bringing about a realization on the part of all of those engaged in construction work—whether public or private—that wasteful or selfish methods must be abandoned if the building industry expects to carry to completion all contemplated projects.

It is our feeling that this brief explanation of our situation and an appreciation by you of its seriousness will suggest the advisability of an appeal to buyers of cement to avoid duplicating contracts and to limit their estimates to their actual needs, and to consumers generally to spread their buying over the months of light demand. We believe that such action would have real weight among those concerned and be of effective benefit to the public generally.

The Answer of the Contractors

On April 25 Secretary Hoover sent a copy of the foregoing letter to the Associated General Contractors of America. On June 25 the contractors' association replied as follows:

Upon receipt of your communication of April 25, enclosing a letter from cement manufacturers relative to the over-ordering of their product by contractors, an immediate effort, as previously indicated, was made by the Associated General Contractors to discourage this practice; and steps were taken to investigate the question of its prevalence, the causes for over-ordering and the possibility of finding a permanent remedy.

The investigation has been carried far enough to reach certain conclusions which are herewith transmitted as a reply to the principal points relative to construction operations mentioned in the letter of the cement manufacturers. These points made either directly or by inference, as we interpret the communication, are as follows:

1. Construction companies, either through excessive caution or a desire to speculate at the expense of manufacturers, contract for cement, greatly in excess of their requirements—the excess amount as indicated by a number of cases investigated, averaging 40 per cent of the actual needs.

2. Cement is sold, presumably against the desire of manufacturers, under a fixed price "specific job contract," which is cancellable by the contractor, but to which the manufacturers submit as a protection to the public against the evils of speculation.

3. The demand for cement should be more uniformly spread and over-ordering or

other wasteful and selfish methods in the building industry should be abandoned if the industry is to function properly.

In reply to these points, the following analysis is offered:

Over-Order to Limited Extent

1. Over-ordering or the duplicating of orders does occur to a very limited extent when construction companies are bound by a completion time limit and penalty under a contract which grants no extension of time for delay in material delivery, or where such delay introduces excessive costs; but no instance has so far been found where over-ordering was practiced merely as a means of speculation. None of the signatories to this communication has knowingly over-ordered cement for any purpose or encountered the practice directly among other members of the industry.

The volume of cement used by contractors has been estimated by the cement manufacturers at 40 per cent of their output, and if all contractors over-ordered 40 per cent, the excess orders would equal some 16 per cent of the total production. That all contractors do not over-order 40 per cent is obvious. Ten per cent is probably an excessive average, and this amount, in so far as construction companies are concerned, would represent excess orders of about 4 per cent of the total production.

2. Cement is almost universally sold under a loose form of contract, which guarantees the price, but which does not bind the seller to deliver a given quantity of material within a given time. Therefore, since the construction company is almost invariably bound to its client under a time of completion penalty, and also faces an excessive loss from delayed material, it commonly occurs that the time element is a more vital factor than a reasonable variation of price. In other words, the construction company sells short on time as well as on price and under the existing form of material contract it cannot cover itself against non-delivery.

How Over-Ordering May be Eliminated

It is important to take cognizance of the fact that on certain types of highly organized construction work, notably highways, which depend upon continuity of material delivery for their success, a delay in material delivery may entail an unavoidable overhead expense of from $30 to $50 per hour. Such an unproductive expenditure is capable of ruining almost any construction company and they dare not trifle with the question of delayed material. If the manufacturer and the dealer, who receives a commission on all cement used in his territory, will assume responsibility for delivery at a given time, the practice of over-ordering or duplicating can doubtless be eliminated. It has birth in the trade practices of cement selling and upon revision of these practices depends its correction. Under existing conditions, it is surprising that the extent of over-ordering is not greater.

Since the manufacturer does not agree to deliver at a given time or rate and since the owner demands his project at a given time, the construction company is obliged to accept responsibility for contingencies which neither of these will assume. In the construction of a modern office building, there may be a score of industries which pass this same contingency along to the construction company, and it is almost inevitable therefore that as long as the present form of material contract exists, construction companies here and there will over-order as a means of self-preservation.

The present form of contract employed in the purchase of cement and various other material is no instrument of construction companies. In fact, they are repeatedly injured by its use and have sought its abandonment. Construction is salted with such instruments, which in the public interest, as well as in the interest of the industry, should be substituted by a system of bona fide mutual contracts, harmonizing with the major construction agreement.

Reliable construction companies have often sought to enter a bona fide non-cancelable contract guaranteeing delivery and acceptance, and relieving seller from delays of transportation, but this offer has been declined. In certain instances where the inability to deliver cement was attributed to lack of transportation, and construction companies offered to provide transportation off dock either by water or rail, these companies were found to be oversold and could not deliver. Overselling as well as over-ordering is an important factor in the expansion period of the construction industry. Any recession of the manufacturers, not only of cement but of other materials, from a stand against the adoption of mutual, non-cancelable sale contracts will unquestionably meet with sincere co-operation from the country's construction companies.

Ask Co-operative Examination of Present Methods

3. The cement companies make a sound constructive suggestion that the demand for cement be more uniformly distributed and that all wasteful and selfish practices in the industry be abandoned. To this there is but one answer: a co-operative examination of existing methods, impartial analysis of the economics and ethics involved and a sincere effort on the part of each industry to govern itself with due regard for commercial rights of every other. It was partly to institute a move in this direction that an open conference of those industries involved in construction was sought last February by the Associated General Contractors.

The general tone of the cement manufacturers' letter and the date of its writing lead one to infer that it was conceived in opposition to a construction conference; but whether this is true or not, we venture to suggest that such conferences are an essential factor of the co-operative stage into which industry is emerging. With rapid strides, the trade association is casting aside many features of the competitive system and has reached that stage of group co-operation where the principal evils of the competitive plan still survive, but where the public has not derived its share of benefit from the co-operation.

To give the public this benefit, ethical conduct within the individual industries and control of the business cycles are essential, and we desire to see these possibilities developed within construction. Cyclical control in this industry has been proved feasible within the past two months and there is little excuse for allowing it to repeat the rampage of 1920. This entire question is interlocked with the problem of inducing industries as units, to exercise proper government of themselves and to share the burden of adjusting a changing system of economics. If this course is not followed voluntarily, it will doubtless be followed under the distasteful pressure of law.

We believe that all data compiled by trade associations in connection with co-operative action of their members be made available to the public and that the councils of these associations be thrown open to any interested governmental official or other citizen of the country.

This communication is signed by President J. W. Cowper, of the association, and the officials of 21 representative companies in that body.

Plans to Purchase and Combine Several Missouri Limestone Plants

IT IS QUITE evident that the rock products industry in Missouri is to soon be revived and that it will be recognized as a leader industry in that state after several years of practically insignificant existence. This conclusion is arrived at from the information given by R. Newton McDowell, financial agent, of Kansas City, who called at the offices of ROCK PRODUCTS on June 25.

Mr. McDowell has been investigating the stone industry in Missouri for the past several months with a view of determining the possibilities of producing coarse aggregate in the amount that will be required by the state to build $60,000,000 worth of roads in the next five years.

In view of the fact that the state's program calls for the purchase of all aggregates by the state which will in turn sell it to the contractors, Mr. McDowell, and the interests which he represents, recognized that the crushed stone industry would have to be greatly enlarged to take care of the demand. This is because there are no more than eight or nine operations, exclusive of those in and near St. Louis and Kansas City, north of the Missouri river. The total maximum output of these plants is said to be 175,000 tons per year, which is one-sixth the amount required per year for road building.

The investigation which Mr. McDowell has been conducting has been an unusually extensive one and approximately $40,000 has been expended in learning the possibilities. Every stone deposit north of the Missouri river has been tested and options have been taken on all desirable properties obtainable. At the present time, those under consideration are as follows: S. J. White Stone Co., Blackwater, Mo., in central Missouri on the Missouri Pacific Ry.; Acme Limestone Co., West Lime, Mo., in the southern part of the state on the Kansas City Southern and the Missouri, Kansas & Texas railways; Marblehead Lime Co.'s quarry at White Bear,

Mo., in the northeastern part of the state on the Burlington, the Wabash and the Hannibal Shortline railways; a site at Princeton, Mo., in north-central Missouri on the Rock Island railway; a site at Smithville, Mo., in the northwestern part of the state on the Burlington railway, and the plant and property of the Earnshaw Crushed Stone Co., Gallatin, Mo., also in the northwestern part of the state on the Wabash railway.

As Mr. McDowell knew nothing about the stone business prior to his investigation of the past few months, he has gone about his task in the most intelligent manner possible and is taking nothing for granted and none of the information he has obtained is guesswork. His visit to Chicago was for the purpose of obtaining the services of the best informed operating men and engineers obtainable to go with him to Missouri to make estimates on the cost of production at the sites he and his engineers have selected.

The following men made up the party which left Chicago on June 28 with Mr. McDowell: Daniel Foley, president, Federal Stone Co., Chicago; P. G. Black, general manager, Brownell Improvement Co., Chicago; A. J. Sullivan, president, Inland Crushed Stone Co., Chicago; J. F. Rhodes, manager in charge of quarry operations for Lehigh Portland Cement Co. at Mitchell, Ind.; E. L. Sandborn, engineer in charge of sales, Worthington Pump and Machinery Corp., Cudahy, Wis., and J. M. Johnson, engineer in charge of sales, Allis-Chalmers Mfg. Co., Milwaukee.

These men, at each operation, will make individual estimates on the cost of production and the average of the estimates will be accepted by Mr. McDowell as authoritative. Messrs. Johnson and Sandborn will make estimates on the cost of plants to be built or rebuilt at each site.

"All of my investigations may be in vain," said Mr. McDowell, when interviewed by a Rock Products editor at the Blackstone hotel a few hours prior to the party's departure for Missouri, "because it is possible that I may be underbid. I do not pretend to believe that I have the situation 'cinched,' for it is quite possible for anyone else to try to get in. However, I do not believe that it is probable that anyone else can offer the state coarse aggregate at the low figure I hope to be able to quote. This is because I will have a much larger organization and can operate on a far greater scale. The sites I have chosen were selected with consideration for their geographical position and I believe I will be able to supply stone to any point in the territory I serve with a maximum haul of 100 miles.

"I will do nothing in the way of developing and building until I have been officially informed that I am the lowest bidder. If I am the fortunate bidder, I will be in a position to begin immediately so that all of the plants can be producing next spring. On June 1, B. H. Piepmeier, chief state highway engineer, was authorized by the highway commission to advertise for bids for the furnishing of all aggregates to the state for a five-year period. As this must be advertised for 21 days, I will have ample time to complete my investigations and prepare my bid."

Missouri Asphalt Company Secures Charter

A NEW COMPANY, known as the Missouri Rock Asphalt Co., Chillicothe, Mo., has recently been issued a charter by the state for the development of a 17,000-acre asphalt-bearing property in Carroll and Livingston counties. According to Harry W. Graham, secretary of the Chillicothe Chamber of Commerce, the State Highway Department will make an analysis of the asphalt to determine its value as road-building material. Negotiations are under way, according to Mr. Graham, for the building of a $100,000 plant and a railroad spur to the property.

It was not generally known that asphalt existed in the oil field south of Chillicothe until the Chamber of Commerce had samples of the oil-sandstone and the crude oil analyzed in the latter part of April. The analysis developed that there are two features of importance existing in the deposit—rock-asphalt, testing 8.7 asphalt and 91.3 silica sand; and crude oil having an asphalt basis with a specific gravity testing .967, which comes within the requirements for all road purposes, the requirements ranging from .950 to 1.010. The test also showed total bitumen content of 99.9; a specific velocity at 60 deg. C., of 100.7, and 70 per cent asphaltum.

Further investigation through the state highway department developed that the product contains all the ingredients stipulated in the state specifications for the construction of asphalt roads.

Affairs of the Solvay Process Co.

THE six months' lease held by the Solvay Process Co. of Syracuse, N. Y., on the plant of the Kansas Chemical Mfg. Co., at Hutchinson, Kans., will expire October 1. Officials have not indicated what disposition will be made of the plant. The six months' lease was executed to give officials of both concerns margin to work out plans mutually satisfactory.

Stockholders in the Kansas Chemical claimed in the spring, when a 10-year lease held by the Solvay was about to expire, that if the leasehold was dropped they would be left with a "white elephant" on their hands; that the concern could not be economically operated as an independent company and in competition with the Michigan plant of Solvay, manufacturing the same commodities, alkali products.

Controlling interest in the Kansas plant was acquired in 1912 by a group of Solvay officials. In 1913 they negotiated a 10-year lease with Solvay for the plant. One of the provisions was that all improvements made by the leasing company, subject to approval by Kansas Chemical stockholders, should be repaid at expiration of the lease, with allowance for depreciation and use. In return Solvay guaranteed a return of 5 per cent annually on common of Kansas Chemical.

Its stockholders believe, however, that repayment for heavy war-time additions and improvements will be a heavy burden; in addition, the plant cannot be operated except at a loss. The outcome is awaited with interest by persons interested in the rock products industry.

The Solvay Process Co., which is a part of the Allied Chemical and Dye Corp., has abandoned development of 1000 acres of land on Chaumont Bay, Lake Ontario, as a source of limestone which was acquired in 1920. Options on other land in the vicinity have been allowed to lapse.

The reasons assigned for the new policy is that it costs too much to transport the limestone from Chaumont to Syracuse. The freight rate is now $1.25 a ton, an increase of 30 cents a ton. There are large deposits of limestone on the Chaumont property and it will be reserved for use in the future.

In the meantime the company will work its quarries at Jamesville, N. Y., and in Michigan. Additional property has been secured along the ridge east of the Jamesville property, adding extensively to the big quarry in this region. It is understood there are considerable quantities of limestone along the ridge for a distance of a dozen miles, which eventually may be acquired.

New Cement Plant at Moundsville, W. Va.

THE Kerr Portland Cement Co., of Wheeling, W. Va., which was recently organized, has selected a site at Beech Bottom, near Moundsville, for the construction of a new cement-manufacturing plant.

The initial mill will consist of a number of buildings, equipped for an output of about 3000 bbl. per day. The plant is estimated to cost in excess of $1,000,000, with machinery, and will give employment to more than 400 men. It is expected that the mill will be ready for operation in about 12 months.

Mississippi to Operate Its Lime Plant

ACCORDING to the announcement of F. L. Thames, penitentiary trustee, the lime plant in this county, about two miles above Waynesboro, Miss., will be repaired and put in operation at an early date.

The plans are to move the plant several hundred yards back from its present location, to put it in good condition and put to work many convicts here as are needed. Work will begin on the plant just as soon as the necessary equipment can be secured.

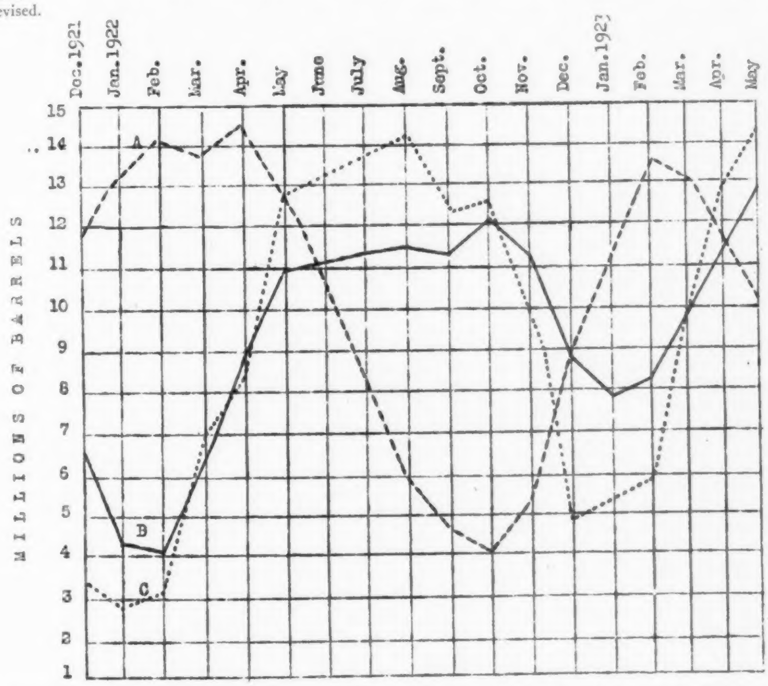
Portland Cement Output in May

THE statistics shown in the following, issued by the Department of the Interior, and prepared under the direction of Ernest F. Burchard, of the Geological Survey, are based mainly on reports of producers of portland cement, but in part on estimates. The estimates for May, 1923, were made necessary by the lack of returns from two producers.

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN MAY, 1922-23, AND STOCKS IN APRIL, 1923, IN BARRELS

	Production May		Shipments May		Stocks at end of May		Stocks at end of Apr.,
Commercial District	1922	1923	1922	1923	1922*	1923	1923*
East. Pa., N.J., Md.	2,964,000	3,347,000	3,708,000	3,782,000	3,563,000	3,342,000	3,778,000
New York	549,000	683,000	680,000	729,000	869,000	759,000	804,000
Ohio, W'n Pa., W.Va.	998,000	1,393,000	1,092,000	1,424,000	1,302,000	1,011,000	1,042,000
Michigan	713,000	722,000	743,000	806,000	782,000	555,000	640,000
Ill., Ind., Ky.	1,883,000	1,965,000	2,068,000	2,511,000	2,361,000	755,000	1,301,000
Va., Tenn., Ala., Ga.	509,000	643,000	628,000	672,000	399,000	184,000	213,000
E'n Mo., Ia., Minn.	1,247,000	1,287,000	1,381,000	1,472,000	1,700,000	1,509,000	1,694,000
W'n Mo., Neb., Kans., Okla.	726,000	902,000	726,000	856,000	854,000	929,000	883,000
Texas	271,000	375,000	323,000	424,000	291,000	235,000	284,000
Colo., Utah	250,000	288,000	249,000	274,000	164,000	177,000	163,000
California	757,000	977,000	831,000	977,000	259,000	139,000	139,000
Ore., Wash., Mont.	309,000	328,000	320,000	330,000	349,000	520,000	522,000
	11,176,000	12,910,000	12,749,000	14,257,000	12,893,000	10,115,000	11,463,000

*Revised.



(A) Stocks of finished portland cement at factories. (B) Production of finished portland cement. (C) Shipments of finished portland cement from factories.

Stocks of clinker, or unground cement, at the mills at the end of May, 1923, amounted to about 4,454,000 bbl. compared with 5,006,000 bbl. (revised) at the beginning of the month.

Missouri Preparing to Finance Independent Cement Plants

THE Missouri Highway Department, in an effort to force down the prices of road-building materials, is preparing to finance the construction of cement plants. Data is being gathered on the cost of producing cement, crushed stone and sand, so that the state can bring down high costs. It is said that plans will save the state several million dollars.

The highway commission will shortly ask for two kinds of bids to supply the state with cement, crushed stone and sand for a period of five years. One bid will be from established producers and dealers in the three kinds of building materials; the other bids will be from persons who desire to be financed by the state in producing cement, crushed stone and sand.

Chairman Theodore Gary rejected the suggestion that suits be brought to break alleged combines of material men, saying that court action had proved of little avail in the past, and that he proposed a more direct method. Mr. Gary did not favor material plants owned and operated by the state.

The dealers and operators are expected to enter strenuous objection. The highway department will permit the established firms to have the state's business provided they make reasonable bids. No charge is made officially that combines exist to control material prices.

The state does not propose to finance every bidder. The bidder must show he is familiar with the cement, stone or sand and gravel business, and able to put up sufficient bond to protect the money advanced by the state to build the cement plant, or to provide the equipment for quarrying rock or for digging sand from the river.

The department also will take advantage of the road law provision permitting it to condemn material plants, quarries or sand deposits. The state is permitted under the law to condemn the sand deposits, then turn them over to an operator financed by the highway department.

A tentative proposal has been made already to furnish stone to the state for about 50 cents a ton under prevailing prices.

The materials for which bids are to be asked for a five-year period will not be on a flat price for the duration of the contract. The prices must vary with changing costs of labor, fuel and other elements entering into the cost of production.

Until next November the state will have available the $2,000,000 appropriated at the special road session in 1921 to finance persons desiring to enter into the cement, stone and sand business for the state. The appropriation was not renewed by the legislature last winter.

Texas Protects Sand and Gravel Bed from Private Exploitation

ALL sand and gravel in the public streams of Texas are claimed by the state and surveys are to be made immediately to define the boundaries of these streams as a basis for protecting the sand and gravel beds from private exploitation except when authorized by the state game, fish and oyster department which exercises jurisdiction over them.

The first surveys will be made along the Colorado river in and adjacent to Austin, where large beds of valuable sand and gravel are located and which have been a local source of building material for years. The state is going to collect 5 cents per yard for sand and 6 cents for gravel. It is to be collected by the game, fish and oyster department.

Mr. Simmons also said that the statute of limitation does not run against the state; therefore the state will have surveys made and establish the proper lines, so it will have clear title to the sand and gravel in the beds. This doctrine has already been put into effect by the land commissioner, who issues oil and gas permits in public stream beds.

A law has just been passed which permits the condemnation of roadways over abutting land so that the state's sand and gravel may be hauled from river beds. Mr. Simmons said condemnation will occur wherever necessary to open passageways.

Traffic and Transportation

By EDWIN BROOKER
Munsey Building, Washington, D. C.

Railroads Increase Rates in Southern Territory

THE railroads in Southern territory have made the initial move to bring about increases in the rates on sand, gravel and crushed stone to a basis approximating the so-called Georgia mileage scale. They have selected the rates from pits on the Charleston & Western Carolina railway to all points and C. & W. C. Tariff I. C. C. No. A-806 has been issued, making increases ranging from 7 to 60 cents per ton. The rates to a number of points on connecting railroads have been canceled, irrespective of the fact that many of such destinations are available markets to producers located on this railroad.

The rule for constructing combination rates, as per Kelly's Tariff No. 228, which allows a 30-cent reduction from the total of combination rates, has also been dropped from the new tariff, which means a further increase of 30 cents per ton on shipments on which a combination of locals now apply.

The proposed increases are being vigorously contested, not only by producers located on this railroad but by consumers as well. A petition seeking a suspension of the tariff referred to has been filed by Edwin Brooker, traffic counsel, Washington, D. C., for the Southern Paving Gravel Co., of Savannah, Ga., and the Carolina Cement Gravel Co. of Hattieville, S. C. A similar petition has been filed by the Thomas E. Grady Co., of Savannah, Ga., for account of the cities of Savannah, Brunswick and various counties in eastern Georgia.

While the decision of the I. C. C. on these petitions cannot be forecast, everything is being done to prevent the new rates from taking effect on July 1, 1923.

Proposed Changes in Rates

THE following are the proposed changes in freight rates up to the week beginning June 25:

Central Freight Association

6606. Sand and Gravel, Lafayette, Ind., to Kokomo, Ind. Present, 81 cents per net ton; proposed, 76 cents.

6610. Crushed Stone, New Paris to Springfield, Ohio. Present, 80 cents per net ton; proposed, 70 cents.

6615. Ashes, Cinders (except mill cinder and scale and pyrites ore cinder) and Furnace Slag, Weirton, Follansbee, W. Va., and Steubenville and Mingo Junction, Ohio, to P. & W. Va. and W. S. B. Present, no class or commodity rates in effect. Proposed, per net ton to Hopedale, $1.25; Wayco, $1.25; Reed, $1.15; Chandler, $1.15; Smithfield, $1.15; Kolmont, $1.05; to Cliftonville, W. Va., inclusive, $1.05; Bellfield, Pa., $1.05; Virginia, W. Va., $1.05; Penowa, Pa., $1.05; to Woodraw, Pa., inclusive, $1.03; Hickory, Pa., 90 cents; to Gwendalen, Pa., inclusive, 90 cents; South Carnegie, Pa., 90 cents; Rook, Pa., 90 cents; Pittsburgh, Pa., 90 cents; Pgh. S. S. team Tracks, 90 cents; West Side Belt Stations, Pittsburgh, West End, Pa., 90 cents; West Liberty, Pa., 90 cents; to Longview, Pa., inclusive, 90 cents; Horning, Pa., $1.05; to Large, Pa., inclusive, $1.05; Option, Pa., $1.05.

6616. Cement, Mitchell, Sellersburg and Speeds, Ind., to Edward Hines Yellow Pine Trustees R. R. and Gulf & Ship Island R. R. listed in I. F. A. T. B. tariff 108j. Present, no commodity rates in effect. Proposed, same rates as in effect from Hannibal, Mo.

6621. Crushed Stone, etc., Holland, Ohio, and Monroe, Mich., to Ohio. Present and proposed (in cents per net ton); Crushed Stone from Holland, Ohio.

To:	Present	Proposed
Denson, Ohio	(a)	$0.90
Oak Shade, Ohio	(a)	.90

From Monroe, Mich., stone, crushed, rough (not dimensions), rubble, rip rap and limestone screenings.

To:	Present	Proposed
Denson, Ohio	(a)	$1.15
Oak Shade, Ohio	(a)	1.15
Ottokee, Ohio	(a)	1.07
Naomi, Ohio	1.26	1.07
Gerald, Ohio	1.26	1.07
Hamler, Ohio	1.26	1.15
Gallup, Ohio	1.26	1.15
Prentiss, Ohio	1.26	1.15

(a) No commodity rates in effect.

6625. Crushed Stone and Screenings in bulk in open top equipment, Lisbon, Ohio, to points in Pennsylvania. Proposed, illustrations in cents per net ton.

To:	
Beaver	$0.90
New Brighton	.90
Freedom	.90
Pittsburgh	1.05
Carnegie	1.05
Canonsburg	1.15
Wilkinsburg	1.05
East Pittsburgh	1.05
Export	1.25
Irwin	1.25
Greensburg	1.25
Heila	1.60
Larobe	1.40
Blairsville Int.	1.60
Duquesne	1.05
Clairton	1.25
Donora	1.25
California	1.60
Brownsville	1.60
Rice Landing	1.60
Tarentum	1.25
Butler	1.40
Vandergrift	1.40
Apollo	1.40
Indiana	1.60
Verona	1.25
New Kensington	1.25
Leckrone	1.75

6626. Sand and Gravel, Urbana, Ohio, to Gretna, De Graff, Quincy, Pemberton and Sidney, Ohio. Present, 70 cents per net ton; proposed, 60 cents per net ton.

6627. Crushed Stone and Crushed Stone Screenings, Bedford-Bloomington, Ind., district to Toledo, Ohio. Present, 23 cents; proposed, $2 per net ton.

6645. Crushed Stone, from Lewisburg, Ohio, to Xenia, Ohio. Present, sixth class; proposed, 80 cents per net ton.

6649. Sand (except blast, engine, foundry, glass, molding or silica) and Gravel, from Hadley, Pa., to Electra, Pa. Present, $1.25 per net ton; proposed, $1.05 per net ton.

6654. Crushed Stone and Crushed Stone Screenings, in bulk, and Limestone, unburned, agricultural, in bulk when shipped in open top cars only, from Bluffton, Ind., to Angola and Auburn, Ind. Present, $1.27 and $1.04 per net ton; proposed, $1.01 per net ton.

6658. Sand (except blast, engine, foundry, glass, molding or silica) and Gravel from Hadley, Pa., to Ohio and Pennsylvania. Present, sixth class; proposed (per net ton) illustrations:

To:	Rate
Adamsville, Pa.	$0.80
Andover, Ohio	.80
Clarendon, Pa.	1.25
Cleveland, Ohio	1.40
Conneaut, Ohio	1.15
Corry, Pa.	1.25
East Sandy, Pa.	1.05
Erie, Pa.	1.15
Fredonia, Pa.	.80
Girard, Pa.	1.15
Grove City, Pa.	.90
Hubbard, Ohio	1.05
Jamestown, Pa.	.80
Latimer, Ohio	1.05
Meadville, Pa.	.90
Niles, Ohio	1.15
North Girard, Pa.	1.15
Painesville, Ohio	1.15
Pittsfield, Pa.	1.25
Ravenna, Ohio	1.25
Sandy Lake, Pa.	.80
Sharon, Pa.	1.15
Sharpsville, Pa.	1.15
Spartansburg, Pa.	1.15
Stoneboro, Pa.	.80
Titusville, Pa.	1.05
Union City, Pa.	1.25
Warren, Ohio	1.25
West Middlesex, Pa.	1.05
Youngstown, Ohio	1.15

6660. Sand and Gravel from Miamiville, Ohio, to Springfield, Ohio. Present, 14 cents; proposed, 70 cents per net ton.

6661. Crushed Stone, from New Paris, Ohio, to Oxford and College Corner, Ohio. Present, $1 per net ton; proposed, 90 cents per net ton.

6662. Crushed Stone, from New Paris, Ohio, to Vandalia, Tippecanoe City, Troy, Eldean and Farrington, Ohio. Present, 13 cents; proposed, 80 cents per net ton.

6666. Sand and Gravel, from Richmond, Ind., to Winchester, Ind. Present, 75 cents per net ton; proposed, 63 cents per net ton.

6670. Lime, from Huntington, Ind., to Pittsburgh, Pa., Clarksburg and Fairmont, W. Va. Present, 22½ cents to Pittsburgh, 24½ cents to Clarksburg and Fairmont; proposed, 20 and 22½ cents.

6673. Sand and Gravel, from Lafayette, Ind., to Laporte, Belfast, Walkerton and Kingsbury, Ind. Present, $1.39 to Laporte and Belfast, $1.38 to Walkerton, $1.27 per net ton to Kingsbury, Ind.; proposed, $1.10 to all points except Kingsbury, $1.02 per net ton.

6675. Ashes, Cinders (except mill cinder and scale and pyrites ore cinder) and Furnace Slag, from Canton, Ohio, to Freesburg and Paris, Ohio. Present, 9½ cents; proposed, 60 cents per net ton, minimum weight 80 per cent of marked capacity of car.

6678. Sand and Gravel, Wolcotville, Ind., to Indiana.

To:	Present (per net ton)	Proposed
Portland, Ind.	$1.01	$0.88
Auburn, Ind.	.81	.63
Butler, Ind.	.85	.63
South Whitley, Ind.	.90	.80
Columbia City, Ind.	.85	.80
Churubusco, Ind.	.81	.80

6679. Sand and Gravel, Bangs, Ohio, to Ashland, Ohio. Present, 13½ cents; proposed, 80 cents per net ton.

6630. Crushed Stone, New Paris, Ohio, to Wengerlawn, Verona, Gordon, Arcanum, Delisle, Jays, Rush's, Hill Grove, Ohio. Present, 90 cents per net ton; proposed, 80 cents per net ton.

6681. Sand and Gravel, County Spur, Mich., to Churubusco, Ind. Present, 17 cents; proposed, 95 cents per net ton.

6682. Sand, Ginger Hill and Rupel, Ind., to Goodrich, Union Hill, Reddick, Blair and Dwight, Ill. Present, $1.01 per net ton to Goodrich and Union Hill, sixth class rate to other points; proposed, 88 cents per net ton.

Illinois Freight Association

377F. Lime, carloads, minimum weight 24,000 lb., to cancel commodity rate of 16 cents per 100 lb., published in Mo. Pac. R. R. Trf. 43810D, Sup. 16, from Glencoe, Mo., to Chicago, Ill., and points taking same rates covered by W. T. L. Territorial Directory 1A. (85-1-37).

1854. Sand and Gravel, carloads, minimum weight 90 per cent of marked capacity of car, 6 cents per 100 lb. from Moline and 8 cents from Ottawa, Ill., to Goodhope, Ill.

1867. Sand and Gravel, carloads, minimum weight 90 per cent of marked capacity of car, $1.06 per net ton from Chillicothe, Ill., to Pekin, Leslie, Tremont, Menert, Mackinaw, Lilly, Wood-

ruff, Danvers, Twin Grove and Bloomington, Ill., and $1.18 to Gillum, Downs, LeRoy, Farmer City, Mansfield, Rising and Champaign, Ill.

1876. Sand and Gravel, carloads, minimum capacity of car, 76 cents per net ton from Lincoln, Ill., to Harristown, Niantic, Lanesville, Dawson and Riverton, 88 cents to Bates, Alexander, Arnold and Jacksonville, Ill., $1 to Buffs, Maysville and Barry, Ill., and $1.09 to Meredosia, Mt. Sterling, Camp Point, Chattom, Denver, Bentley and Carthage, Ill.

1886. Molding Sand, carloads, minimum weight 90 per cent of marked capacity of car, $1.26 per net ton from Dallas City, Ill., to Chicago, Ill.

1875. Sand and Gravel, carloads, minimum weight 90 per cent of marked capacity of car, $1 per net ton from Keokuk, Iowa, to Hannibal, Mo.

1892. Lime Waste, carloads, minimum weight marked capacity of car, $1.65 per net ton from Chicago, Ill., to Joliet, Ill.

1900. Sand and Gravel, carloads, minimum weight marked capacity of car, from Steele, Ill., to stations on C. & A. R. R., e. g., 75 cents per net ton to Plaines, Millsdale, Drummond, Gardner, etc., 90 cents to Dwight, Nevada, Streator, etc., $1 to Garfield, Wenona, Toluca, etc., $1.15 to McNabb, Granville, etc., $1.40 to Middletown, Fancy Prairie, etc., $1 to Pontiac, Chenoa, Bloomington, Atlanta, Lincoln, Springfield, etc. (M. R. P. 206).

1257. Sand, C. L., from Chicago, Ill., and group points to Meridian, Jackson, Vicksburg, Miss., $4.60, Memphis, Tenn., $3.60 and Jackson, Tenn., $3.40 per net ton.

New England Freight Association

4781. Stone, crushed, and articles taking same rates, minimum weight 90 per cent marked capacity of car, except when cars are loaded to cubical or visible capacity, actual weight will apply, from Branford (Pine Orchard Quarry), East Berlin (Beckley's Quarry), East Wallingford (Reeds Gap Quarry), Meriden (York Hill Quarry), New Britain (Cook's Quarry) and Rocky Hill, Conn., to Hope Valley, R. I., $1.25 net ton. Reason, to meet competition of temporary crushers.

4786. Sand, minimum weight 90 per cent marked capacity of car except when car is loaded to cubical or visible capacity actual weight will apply, from Maynard, Mass., to Adit and Davis Bridge, Vt., $1.80 per net ton and to Surge Tank siding, $1.75 net ton. Reason, to permit movement of traffic.

4796. Stone, crushed, grave, screened, sand, building, common or run of bank, minimum weight 90 per cent marked capacity of car, except when car is loaded to cubical or visible capacity actual weight will apply, from Lenoxville, Mass., to Pittsfield, Lee, South Lee, Stockbridge, Glendale, Housatonic, Van Deusenville, Great Barrington and Sheffield, Mass., stone 65 cents net ton, sand 60 cents net ton. Reason, to permit movement of traffic.

4813. Lime and Limestone, minimum weight 50,000 lb., from N. Y., N. H. & H. R. R., producing stations in Berkshires to N. Y., N. H. & H. R. R. stations sixth class, as per N. Y., N. H. & H. R. R. I. C. C. F2424. Reason, cancellation of commodity rates higher than class rates.

4835. Cement, common, hydraulic, natural or portland, minimum weight 50,000 lb., from Hudson Upper, N. Y., to Port Morris (track delivery), Claremont Park, Fordham, Williams Bridge, Woodlawn, Mt. Vernon, Dunwoodie, Bryn Mawr Park and Nepperham, N. Y., 11½ cents. Reason, to publish same rates as proposed from Hudson, N. Y.

4837. Common Lime, minimum weight 40,000 lb., from Charlestown, N. H. (on traffic from beyond), to Fall River, Mass., and Westerly, R. I., 16 cents; Taunton, Mass., and Providence, R. I., 15 cents; Pawtucket, Woonsocket, R. I., and Putnam, Conn., 14 cents; Leominster, Mass., 12 cents, and New York, N. Y., 18 cents. Reason, to encourage and permit movement of traffic.

Southern Freight Association

10259. Stone, crushed, C. L., from Salaco, S. C. (stations on the Chesterfield & Lancaster R. R.) to stations on the S. A. L. Ry, in North Carolina between Hamlet and Raleigh and between Wilmington and Charlotte. It is proposed to reduce present rates to be in line with rates applicable from Columbia, S. C., and North Carolina shipping points. The rate proposed to Wilmington ($1.35 per net ton) is the same as the rate recently established from Columbia to Wilmington; the rate proposed to Charlotte, N. C. ($1.24 per net ton) is in line with present rate from Columbia to Charlotte of $1.13 per net ton. The proposed rates to other North Carolina stations on the S. A. L. Ry. are on basis of the North Carolina single line scale applied to the continuous distance.

10287. Gravel, C. L., from Paducah, Ky., to Memphis, Tenn., present rates are, on good roads and municipal gravel, $1.08; on commercial gravel $1.40 per ton 2000 lb. Proposed rate on gravel minimum weight, 90 per cent of the marked capacity of car, except when cars are loaded to their visible capacity, in which case the actual weight shall apply, $1.13 per net ton.

10315. Stone, crushed or broken, C. L., from Russellville, Ky., to Central City, Ky. It is proposed to establish rate of 70 cents per net ton, for municipal use only, in lieu of present rate of 72 cents per net ton (commercial rate), cotton sweepings, motes or card strippings, from Pinckard, Ala., to Greenville, S. C. Present rates: C. L., 69 cents; L. C. L., 76 cents per 100 lb. (La Grange, Ga., combination). Proposed rates, C. L., 40½ cents; L. C. L., 50½ cents per 100 lb.

10318. Cement, C. L., from Nashville, Tenn., to Ohio and Mississippi River crossings, Mississippi Valley common and junction points and local intermediates. It is proposed to establish specific commodity rates in line with rates at present obtained from Kosmosdale, Ky., Richard City, Tenn., and other cement manufacturing points. Proposed rates to representative points are, in cents per 100 lb., to Union City, Tenn., 13½ cents; Paris, Tenn., 12½; Dyersburg, Tenn., 16; Somerville, Tenn., 16; Grand Junction, Tenn., 17; Helena, Ark., 18; Tupelo, Miss., 17; Greenville, Miss., 19; West Point, Miss., 19; Columbus, Miss., 19; Vicksburg, Miss., 20; Meridian, Miss., 20; Natchez, Miss., 20½; Laurel, Miss., 21½; Gulfport, Miss., 21½; New Orleans, La., 21½; Pensacola, Fla., 21½; Cincinnati, Ohio, 15½; Louisville, Ky., 12½; Evansville, Ind., 13½; Memphis, Tenn., 16; St. Louis, Mo., 18; Bemis, Tenn., 16; Columbia, Miss., 24; Frankfort, Ky., 17; Hopkinsville, Ky., 12½; Lumberton, Miss., 21½; Paris, Tenn., 17; Winchester, Ky., 17. No full line of commodity rates are in effect at the present time.

10319. Sand, C. L., minimum weight capacity of car, from Chicago, Ill., and points taking same rates to points named below. Class "A" rates apply at present. It is proposed to establish the following rates: To Meridian, Jackson, Miss., Vicksburg, Miss., $4.60; Memphis, Tenn., $3.60; Jackson, Tenn., $3.40 per net ton.

10322. Gravel, C. L., from Gano Spur, Miss., to Baton Rouge, La., and intermediate points. Present rate, 6 cents per 100 lb.; proposed rate, 5 cents per 100 lb.

10360. Lime, C. L., minimum weight 30,000 lb., from Cumberland, Ala., to Moss Point, Miss. Present rate, $3.60 per net ton; proposed rate, $3.72 per net ton, same as in effect from Sherwood, Tenn., and Graystone, Ala., group kilns.

Southwestern Freight Bureau

8674. Gypsum Rock. To amend Item 1110-A, Arkansas Freight Distance Trf. 5-B, to include gypsum rock, between Arkansas points, at same rate as applicable on sand, gravel and crushed rock.

Remarks. It is contended that this commodity is no different than other crushed stone and should therefore be included at same rates as applies on sand, gravel and crushed snote throughout Arkansas.

8687. Sand and Gravel. To establish rates based on the Oklahoma scale, as outline in Item 315 S. W. L., Trf. 55-G, on sand and gravel, carload, minimum weight marked capacity of car, but not less than 40,000 lb., from Rock Spur, Ark., to stations on the T. O. & E. Ry.

Remarks. It is claimed that shippers are unable to move this traffic under the present class rates and that there should be no objection to establishing the scale applicable in Oklahoma.

8713. Cement, natural, of portland, etc., to publish same rates on cement, natural or portland (building cement), from Portland, Ga., to points in Louisiana, as now apply from Rockmart, Ga., as per items in Speiden's Trf. 96B, I. C. C. 715.

Remarks. It is claimed that Portland, Ga., being in the immediate vicinity of Rockmart, should be entitled to the same rates.

8725. Sand, Gravel and Crushed Stone. To establish on sand, gravel, crushed stone, chatts, etc., in straight or mixed carloads, minimum weight 90 per cent of marked capacity of car, but not less than 60,000 lb. from, to and between points in Missouri, state and interstate, rates proposed by the Commission in Docket 9702, 77 I. C. C. 473, for application between certain points in Missouri.

Remarks. At the present time there are varying scales applying on Missouri state and interest of uniformity, it is contended, that the scale prescribed by the Commission for application in certain portions of Missouri should be established.

8733. Cement, Plaster, etc. To establish same rates on cement, plaster and articles taking same rates, carloads, from Murfreesboro and Gypsum City, Ark., to all Texas points shown in S. W. L. Trf. 31F, as published in S. W. L. Trf. 31F, from Southard, Okla.

Remarks. A gypsum quarry has recently been established at Gypsum City near Murfreesboro, Ark., producing gypsum rock, also cement plaster, and it is contended that rates from these points should be established on a parity with the rates from Southard and El Dorado, Okla.

8734. Gypsum Rock. To establish rate of 11½ cents per 100 lb. on gypsum rock, carloads, from Murfreesboro and Gypsum City, Ark., to Harry's and Eagle Ford, Texas.

Remarks. Same as 8733.

8735. Gypsum Rock. To establish rate of 15½ cents per 100 lb. on gypsum rock, carloads, from Murfreesboro and Gypsum City, Ark., to Cementville, Texas.

Remarks. Same as 8722.

8736. Cement Plaster, Stucco, etc. To permit the mixing of cement plaster, stucco, etc., and lime at the higher rates on the entire shipment for application between points in Southwestern Freight Bureau territory.

Remarks. This proposal contemplates the permission to mix various articles of the same kind throughout Southwestern Freight Bureau territory.

8761. Cement. To establish rate of 13½ cents per 100 lb. on cement, carloads, from Ada, Okla., on M. K. T. Ry. to stations on the Oklahoma Union Ry.

Remarks. The proposed adjustment contemplates the establishment of rates on this traffic which will place points on the Oklahoma Union Ry. on a parity with points on other short lines in Oklahoma.

8764. Cement Plaster and Gypsum Products. To consider the following questions with respect to revision of rates on cement plaster and gypsum products between Western Trunk Line and Southwestern Freight Bureau territories, also between points in Southwestern Freight Bureau territory.

1. Advisability of adopting the distance principle in adjusting rates on plaster and gypsum products from all sources of supply to common markets.

2. Suitability of the scale fixed by the Interstate Commerce Commission in the Grand Rapids Plaster Co. case, 62 I. C. C. 237, extended to include distances under 170 and over 700 miles, for use within Western Trunk Line territory and from points of production in other territories to destinations in Western Trunk Line territory.

3. If the Grand Rapids scale is used in fixing rates to destinations in Western Trunk Line territory, determination of suitable scale to be used within Southwestern Freight Bureau territory and from points of production in other territories to destination in Southwestern Freight Bureau territory.

4. Method of applying mileage scale and publishing rates, giving consideration particularly to the following:

(a) Grouping of points of origin and mileages to be used from grouped origin points.

(b) Method of figuring mileages, i. e., use of actual mileage from each point of origin to each destination; use of distance to common points and intermediate local points where distance between common points exceeds 25 miles with common point rate held as maximum at intermediate local stations; use of mileages via actually used routes or via workable routes composed of not to exceed three separate railroads.

(c) If different scales are adopted for use in Western Trunk Line territory, territory west of the Missouri river and Southwestern territory, shall the rate applying in the destination territory determine rates from all points of origin?

5. Adoption of uniform minimum weights and commodity descriptions.

Remarks. The changes referred to in the foregoing are suggested in the interest of securing uniformity in, description, rates and minimum weights throughout Western territory.

8766. Sand, Gravel, Crushed Stone, Riprap, etc. To establish on sand, gravel, crushed stone, etc., in straight or mixed carloads, minimum weight 90 per cent of marked capacity of car, but not less than 60,000 lb., from Missouri points to points in Missouri, Kansas and Nebraska, the scale of rates prescribed by the Interstate Commerce Commission in Docket 9702 (77 I. C. C. 473) for interstate application.

Remarks. The change contemplated by the foregoing is for the purpose of securing as nearly as possible uniform rates on these commodities from, to and between points in the states named.

Trunk Line Association

11436. To publish rates on cement, common, hydraulic, natural or portland, minimum weight 50,000 lb., from producing points in 60 and 66½ per cent territory to stations on the Washington division of Southern railway, Springfield to Lynchburg, Va., inclusive; from 60 per cent territory, 19½ cents; from 66½ per cent territory, 21 cents.

11439. Cement, common, hydraulic, natural or portland, C. L., minimum weight O. C., from Hagerstown, Md., to Winchester, Va., Martinsburg, W. Va., Williamsport, Md., Shippensburg, Pa., and other points, 7 to 12½ cents per 100 lb.

11440. Cement, common, hydraulic, natural or portland, C. L., minimum weight 50,000 lb., except when for carriers' convenience cars of less capacity are furnished, in which case minimum weight will be the marked capacity of car furnished, but in no case less than 40,000 lb., from Hudson, N. Y., to Nepperhan, Bryn Mawr Park, Dunwoodie, Mt. Vernon, Woodlawn Bridge, Fordham, Claremont Park, Port Morris (track delivery), N. Y., 11½ cents per 100 lb.

11456. Cement, common, hydraulic, natural and portland, C. L., minimum weight 50,000 lb., except when for carriers' convenience cars of less capacity are furnished, in which case the minimum weight will be the marked capacity of car, but in no case less than 40,000 lb., Chapman, Evansville, Egypt, Lesley, Ormrod, Saylor and West Coplay, Pa., to Virginian Railway Stations, Goode to Phenix, Va., inclusive, Keever to Altavista, Va., inclusive, and other points, 26½ to 27 cents per 100 lb.

Quarried from Life

By Liman Sandrock

One of Us Serves His Community

"I NOT ONLY BELIEVE that the best men should be drafted, but—*I draft 'em!*" said Gifford Pinchot, governor of Pennsylvania, to *Collier's* recently.

Did Chicago's Mayor Dever have in mind this plan of building up his administrative forces when he induced John J. Sloan, secretary of the Wisconsin Granite Co., to accept the presidency of that city's Board of Local Improvements?

Today, we are confronted by the demand that politics be kept in the background and that Service come to the front if we would run the affairs of a great city economically, efficiently, and satisfactorily. The affairs of an American city can't be properly conducted by second-raters. "We must *throw out* the bad ones and *pull in* the good ones—both by the neck."

John Sloan is known in his city, in his industry, and by thousands of his fellows as a man of fine integrity and force of character, full to the brim of zeal and energy and in every way fitted by temperament and training to fill the responsible office to which he has been appointed—or, may be, drafted!

However Chicago may have been thompsoned or lundined or smalled in the past, confidence is widely expressed that this city is now on its way to good government and exemplary administration.

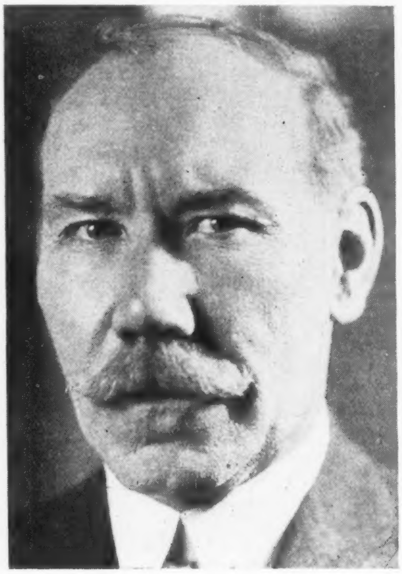
It is quite futile to recite Mr. Sloan's achievements in our industry; to tell of his record as a member and guiding hand in the National Crushed Stone Association; of our high esteem for him as a man and a brother, for we already know of them. It is his willingness to sacrifice his private interests and devote his talents to the state that we would point out.

Undoubtedly, the first thought in the mind of the American citizen today is: Rotten politics must go and clean administration carry on if we would hope to overthrow the damnable influences of the bolshiviks and the I. W. Ws. in their attempt to disrupt our God-given right to be clean and rightly protected citizens of the grandest country on the face of Mother Earth.

We all think this. We all say this. But—we look to the other fellow to give over his private interests and assume the helm of state. You and I just don't want the job!

Men of the stamp of Gifford Pinchot, the disciple and friend of the one and only Teddy, are our great need at the present time. And it is profoundly gratifying to know that one of our industry not only measures up to this high standard, but is willing to get in and fill a place of great usefulness in his community. And he is John Sloan!

His is a big job—the presidency of the Chicago Board of Local Improvements is the biggest job in Mayor Dever's cabinet. He will have the spending of hundreds of millions of dollars every year. He will determine how all this immense sum shall be spent. He will preside over a body that not only has general supervision of all the engineering departments, but has entire say over its finances—the appraisal of property, special assessments, condemnations, and the like.



John J. Sloan, our "First Citizen"

"Draft Will Kill Out Graft" is the caption heading *Collier's* forceful article telling of what Governor Pinchot has already achieved in Pennsylvania. In many respects, that state has suffered from the same ailment which has afflicted Illinois and the city in which we live and endeavor to do business.

The sober thought to us is: What are we, individually, willing to do for good citizenship and clean government? Will we continue to sit back supinely and criticize and let the newspapers find ineffectual remedies for our ills, or—will we obey the call of the "draft"—as John Sloan has done—and do our durnedest to heed the cry of that draft in the service of clean, efficient and progressive government?

We are main proud of you, brother Sloan, and we look to you to do big things at your new post of honor and responsibility. You have the heartfelt wishes of your many friends and co-workers in the industry. And we know you will go over the top to the everlasting credit of us!

Just Before Pay Day

WE can't all own plants, and quarries and such. Some of us must perforce be salaried employes—just "help," if you like it that way. It is with this thought in mind that we publish Christopher Morley's touching poetic paraphrase on "'Twas the Night Before Christmas," so dear to our boyhood:

'Twas the night before pay day, and all through
my jeans
I hunted in vain for the price of some beans.
Not a quarter was stirring—not even a jit;
The kale was off duty, milled edges had quit.
Forward, turn forward, O Time in thy flight—
Make it tomorrow, just for tonight!

They Said It

ONE OF OUR PIOUS but eminently practical producers says: "Pray, yes; but when you get off your knees, don't sit down. Hustle!"

CAP'N CHARLES WARNER and First Officer Phillips have gone ashore, turning the *Lime Association's* quarter deck over to Cap'n Wood and his fellow mariners. But that stanch ship is in skilled hands and the new navigators will sail charted seas and stand clear of sunken reefs and derelicts. Good luck, shipmates, and may a calm sea and a full cargo be yours!

REPORTS HAVE IT that 3,000,000 motor cars and trucks will be made this year. Then we'll have to dodge, brothers, when we ford the boulevard to get our breakfast rolls from Royce's bakery.

BROTHER ZANDER, president of the Sand-Lime Brick Association, has a host of friends. The other day a group of them told us we should make him the stellar attraction on this page. We'll do it!

WITH APOLOGIES TO "K. C. B."
RUS Ostrander.
WHO edits "Novo Power."
SAYS there was a man.
WORKED in a shipyard.
ALL his life.
AND when he had a baby.
AND it was to be christened.
THIS man couldn't sleep.
FOR a week.
'CAUSE he was scared.
THE minister would hit it.
WITH a bottle.

ALL this to us.
MAKES us wonder.
IF a stone man.
SOMETIMES lies awake.
IN the stilly night.
FOR fear when sleeping.
HE will choke up.
AND dream his jaw crusher.
IS choking, too.
MUCH obliged!

—H. E. H.

Editorial Comment

The Lime Convention

Entirely too much food for thought was presented at the recent annual convention of the National Lime Association, for digestion during the convention or for some time subsequent thereto. Elsewhere in this issue we have endeavored to do justice to some of the major issues before the lime industry of America; but we promise to take up other things of almost equal importance when space permits. It is hoped that *all* lime manufacturers will study carefully the report of the convention and the farewell message of President Charles Warner, and will endeavor to appreciate the significance to the lime industry of some of the work now in progress. If such work is along correct lines, it deserves the support of *all* lime manufacturers present, and those to be.

The National Lime Association has initiated experimental work which has resulted in developments of so much commercial import to the lime industry that the association as a corporation feels it necessary and desirable to apply for patents in the name of the association. The scheme of using processes for the benefit of the lime industry under these patents contemplates licensing members of the association under such terms and conditions that the association will retain some form of supervision or control of manufacturing process, or the quality of the product made, or both.

Such a proceeding is a new departure in American trade association work, and its working out will be carefully watched by every industry in the United States. Yet some such scheme of central organization and control seems necessary to meet the novel conditions developed from the experimental work done by the association in the interests of the lime industry.

New building products of unknown, or at least not thoroughly tested, properties have been developed. New processes of untried commercial value have been discovered. Basically, they are lime products and the lime industry will gain or lose prestige according to subsequent experience in manufacturing and using these products and these processes under conditions entirely different from those pertaining to the laboratory in which they were developed and tested—under conditions of competition with other well established and unimpeachable products.

It is easy to understand that under such conditions the wisest leaders of the lime industry urge caution and thoroughness rather than proclaiming to the world that the lime industry has been revolutionized. It is easy to understand why they urge that some supervision of manufacture and some control of the quality of the product must be exercised to save the lime industry from itself as well as from its competitors.

That a trade association which embarks in so novel an enterprise will have a rocky road to travel is obvious. It becomes the actual custodian of the prestige and the reputation of the lime industry—an industry composed, as every industry is composed, of many kinds of men, with many diverse, competitive, conflicting interests. To be "the guiding spirit for the industry" it must have as leaders men of great breadth of vision, unselfish; men of tact and diplomacy, of courage and foresight; men of great moral strength and stability. The lime industry has such men. Every industry, every condition of life has them. It is for their associates to recognize them, and for them to recognize their opportunities and their obligations.

No doubt many of these things were in the mind of Charles Warner when penning his valedictory address as the retiring president. And few men will come nearer to meeting the specifications of a leader of industry than he. His address is a classic for frequent reference in the troublous days ahead.

Any one familiar with recent developments in the lime industry will share his optimism; and his faith that his brother lime producers will carry to successful conclusion the work so auspiciously outlined in this most remarkable 1923 convention of the National Lime Association.

Valuable Resources

It is very common for the average man to regard sand, gravel or crushed stone as so much dirt, dug out of any hole in the ground and sold at a big profit. Of course, as every experienced operator knows, both these popular conceptions are much in error; but even men in the industries are slow to appreciate that they are actually producing and dealing with commodities of which there are truly limited resources.

Already such cities as Buffalo and Kansas City can calculate the end of their sand and gravel resources with just as much certainty and accuracy as the United States Geological Survey can foretell the end of the petroleum and coal resources of the country. One thing that wide-awake producers should do as business men is to make a thorough survey, or have one made, of the resources of material in their market territories. When they have done this, if they are whole-hearted producers, they will know where to invest their surpluses to the best advantage; and they can sit back and philosophically enjoy the sometimes frantic efforts of other operators to *give* their material away. They can well afford to let city, county or state use up every available pocket of commercial stuff with a feeling of absolute certainty that every such deposit used up increases the value of their material still in the ground.

Questions and Answers

Edmund Shaw, Consulting Engineer, Chicago, Ill., Expert on Problems of Screening, Washing and Hydraulic Separation
THE TECHNICAL STAFF OF ROCK PRODUCTS
Edwin Brooker, Washington, D. C., Consulting Expert on Matters of Transportation and Freight Rates
Gordon Smith, First National Bank Bldg., Chicago, Ill., Expert on Crushing and Cement-Plant Problems

No. 66. **Why "Crushed Stone" Is Shipped from California to Illinois.**—In a recent issue of ROCK PRODUCTS I read that crushed stone was shipped from Porterville, Calif., to Waukegan, Ill., and St. Paul, Minn., on a basis of 40 cents per 100 lb. I cannot understand why crushed stone should be shipped such a distance at that rate. Is it a case of these people having a superior grade of stone? Please give me some information on this case and an analysis of the stone.—B. F. L.

A. As to the freight rate from Porterville, Calif., to Waukegan, Ill., and St. Paul, Minn., on a basis of 40 cents per 100 lb. on crushed stone, I suspect that this stone is actually crushed magnesite, which, as you know, is the material from which magnesia or oxychloride cements are made. Evidently in this instance the producers have been able to get a crushed stone rate on the material. All the deposits of commercial magnesite in this country are located in California and Washington, and consequently the magnesite cement plants in various parts of the country are compelled to either have the raw material shipped to them or to have the calcium magnesite shipped. Magnesite, as you probably know, is $MgCO_3$, or magnesium carbonate, and corresponds to $CaCO_3$, or calcium carbonate, from which lime is made.—N. C. R.

No. 67. **Weight of Sand.**—In the June 16 issue of ROCK PRODUCTS I note in this column that bank sand weighs 2500 lb. to the cubic yard. This is about 92½ lb. to the cubic foot. Do not some sands weigh much more than this?—A. D.

A. Fine sand usually weighs about this amount. Good concrete sand will run much higher, 110 lb. to the cubic foot perhaps. It is stated by one authority that good concrete sand should have a specific gravity of at least 1.65, which would mean a weight of 103 lb. to the cubic foot. These are dry weights, but sand is always sold in a moist condition, which would make the weight per foot more if one had to use it in designing a bin, for example. The heaviest sand which the writer has noted was a washed sand from a pit in New York state. In the ordinary moist condition it weighed 135 lb. to the cubic foot and it made an excellent concrete sand.—E. S.

No. 68. **Unloading Scows with Bucket.**—We are unloading sand from a scow with a derrick and clamshell bucket, and owing to the thin bed of sand on the scow the bucket does not pick up a full load. Is there a special bucket made for such work?—F. N.

A. Special buckets, which are wider and lighter than the ordinary digging bucket, are made by several manufacturers for just this work. They are generally advertised as rehandling buckets. It is advised that you write to some of the leading makers of buckets and give them full information as to your problem.—E. S.

No. 69. **Speed of Dredge Pump.**—I want to operate a dredge pump so as to lift 60 ft. through 700 ft. of pipe. How fast must the pump run to do this, pumping the average amount of sand with the water? There are no bends or elbows in the pipe.—M. T. S.

A. To calculate the speed, you must first calculate the total head against which the pump must work. This is divided into three parts: the entry head, which is required to force the sand and water into the suction; the friction head, which is required to force the water and sand through the pipe, and the static head, which is the difference in levels. For the entry head 16 ft. is assumed to be a safe figure. The friction head will depend on the speed with which the water is sent through the pipe, but 7 ft. per 100 is a safe working figure for clear water only. For sand and water it should be increased one-half, or to 10½ ft. per 100. The static head you state to be 60 ft. This will be increased by 10 per cent on account of the weight of the material pumped, or to 66 ft. Adding these we have:

	Feet
Entry head	16
Friction head, 7x10½	73.5
Static head	66

or a total of 155.5 ft. to be overcome. This is more than some manufacturers will recommend their pumps for, but it has been exceeded in practice. The speed for this head may be roughly determined from the formula, $v=7\sqrt{h}$, v being the *peripheral* speed of the runner and h the total head, both in feet. For a runner of 8 ft. circumference, a not uncommon size, this figures out roughly to 660 r.p.m. The pump will send its load of water and sand to this height and through this length of pipe at a lower speed, as the friction head falls off rapidly as the velocity in the pipe line decreases. But in figuring these matters it must be remembered that the velocity in the pipe line must always be sufficient to carry along the sand, for if it is not, the coarser grains will settle out and choke the pipe line. This is especially likely to occur where there is a sag in the pipe. A velocity of 7 ft. a second is about the lowest that can be used with safety from choking. The coefficient 7 in the formula given may not be correct as it varies with different pumps. The writer recently tested a pump to determine this figure and found that it was 7.45 for the particular pump with which the test was made.—E. S.

Who Made the First Single-Roll Crusher?—Under this title S. M. McPherson, general secretary of the British Institution of Quarry Managers, writes to ROCK PRODUCTS:

"Re question No. 53 in your issue of May 5. A single roll crusher was invented and patented in this country in 1890, Patent No. 21096, under the name F. M. Castelnau. This is not written with the idea of disputing what C. S. McLanahan says as, although the above patent precedes the first single-roll crusher made and used by his company, I have no record that one was made and used of the Castelnau type. However, it would seem that the 1890 patentee was the originator and that was the question asked by R. A. J. Another was patented by R. A. Norman in 1891—Patent No. 4085. Although for cereals only, it was practically on the same principle as the 1890 one."

President McLanahan of the McLanahan Stone Machine Co. writes as follows regarding the claim made by his company:

"It may not be generally known that the McLanahan-Stone Machine Co. claim to have made the first single roll *rock* crusher. We do not claim to have made the first single roll crusher, for some 70 years ago I saw a little single roll crusher grinding apples for a cider press and I helped to run that little mill by hand to get a drink of sweet cider. When the phosphate deposits were discovered in Florida, we introduced our machinery for washing the hard rock. As it was necessary to break down the lumps too large for our washers, it occurred to me that a simple little belt-driven crusher, built on the plan of that little cider mill, would do the work better than our double rolls or any other rock crusher, and I arranged with one of the mine owners to furnish him a single roll crusher to be paid for only if it proved satisfactory. The first report from him was an order for another for his other mine. The first one was built in 1894 with a roll only 18 in. in diameter, 24 in. long. We then improved the design and built larger sizes, shipping many for rock phosphate and other material. In 1909, we built the first large crusher for limestone with a roll 24x48 in., and a year or so later a 36x60-in. Both have been in constant operation ever since. The success of these crushers induced other manufacturers to build them, calling them Fairmount crushers or Giant Roll crushers, but, whatever they are named, they are all McLanahan crushers with some variation in the design."

New Machinery and Equipment

A Tractor for Quarries and Plants

THIS model 22 tractor is put on the market by the J. T. Tractor Co., Cleveland, Ohio, with the company's recommendation that it is in use in and around quarries and crushed stone plants in bringing stone out and snapping out trucks, moving heavy machinery, shunting cars, building and maintaining roads, clearing and breaking snow, hauling and moving sand and gravel, clay, etc.

This tractor is hauling 17 tons of stone. On a seven-mile haul the time is claimed to be 3 hr. Only one man in control

When equipped with belt power it can, says the company, be successfully used in crushing stone, pumping out water, and, in case of emergency, act as a power unit almost anywhere around the plant. "There is an almost unlimited variety to the work to which this machine can be accommodated," says the company. "It is particularly simple and sturdy in construction and can be operated by nearly any one with any mechanical knowledge whatever."

Heavier side and truck members and a new motor of the best slow-speed, heavy-duty type, spring mounted and protected by an enclosed hood, and a driver's spring seat with lazy back, are some of the improvements claimed for this tractor.

Traction Wheel Mounting for Railroad Type Steam Shovels

THE Osgood Co., Marion, Ohio, has recently built traction wheel mountings for one of the heaviest railroad type steam shovels, an Osgood No. 120, 6-cu. yd., claimed to be the largest railroad type machine ever built and heretofore mounted only upon standard railroad trucks.

This size of shovel is used in big rock quarries and usually when blasting was in progress it was necessary to lay track and move the shovel back from the excavation and then up again after the explosives and had been set off. These operations were costly.

The company has designed giant traction wheels that measure 6 ft. in diameter and have a face of 36 in. on the drive wheels and 30 in. on the rear wheels. The front wheels are used as drivers and power is delivered through a series of gears from the hoisting engines on the shovel.

Steering is done by turning the rear wheels by means of a screw shaft and traveling nut. The nut, to which is attached the axle tongue, moves along the screw shaft, slewing the rear axle and wheels in the direction desired. The screw shaft is operated by a reversible steering engine mounted above deck alongside the boiler, out of the way yet accessible. Reversing the engine causes the traveling nut to move in the opposite direction. The engine is controlled and steering is accomplished by means of a single lever from the engineer's position in the forward end of the cab.

In recent tests made in a large Pennsylvania stone quarry, it is said, the shovel was moved a distance in one day that under old track-laying methods would have required at least 10 days. The traction mountings are expected to revolutionize the use of large railroad type steam shovels in solid bottom quarries, mines, etc. The traction wheels also eliminate the need for pit men and jack arms.

The advantages of traction wheels over railroad trucks for large railroad type steam shovels briefly summarized are, says this company: Greater mobility, elimination of pit crew, easier accessibility to face of excavation, elimination of tracks and reduction of side strains and racking of the machine. The traction wheels, it is claimed, also have a decided advantage over other types of mounting in that the traction wheels are much less complicated, simpler to operate, and have a lower upkeep cost. The shovel has an over-all length of 85 ft. and the over all width is 20 ft., with a maximum height over the cab of 15 ft., while the boom has a height of 32 ft.

A 3½-cu. yd. traction shovel at the Elmhurst-Chicago Stone Co. quarry on the incline preparatory to backing into the pit

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Blakeslee, N. Y.	1.00	1.25	1.10	1.10	1.10	....
Buffalo, N. Y.	1.30 per net ton all sizes					
Chaumont, N. Y.	1.00	....	1.75	1.50	1.50	1.50
Cobleskill, N. Y.	1.25	1.25	1.25	1.25	1.25	....
Coldwater, N. Y.	1.50 per net ton all sizes					
Eastern Pennsylvania	1.35	1.35	1.45	1.35	1.35	1.35
Munns, N. Y.	1.00	1.40	1.40	1.30	1.30	1.30
Prospect, N. Y.	.80	1.40	1.40	1.30	1.30	....
Walford, Pa.	1.55	1.55	1.55	1.55	1.55	1.55
Watertown, N. Y.	1.00	....	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Alton, Ill.	1.50	....	1.50	1.35	....	....
Buffalo, Iowa	.70	....	1.35	1.15	1.20	1.20
Bloomville, Middlepoint, Dunkirk, Bellevue, Ohio	1.00	1.10	1.10	1.00	1.00	1.00
Chasco, Ill.	1.30	1.25	1.25	1.25	1.20	....
Chicago, Ill.	.80	1.50	1.10	1.10	1.10	1.10
Dundas, Ont.	.95	1.35	1.35	1.35	1.10	1.10
Greencastle, Ind.	1.25	1.15	1.05	1.05	1.05	1.05
Krause, Columbia and Valmeyer, Ill.	1.20	1.20	1.30	1.30	1.30	1.30
Lannon, Wis.	.80	1.10	1.10	1.00	1.00	.90
Mitchell, Ind.	1.00	1.00	1.00	1.00	1.00	1.00
Montreal, Canada	.90	1.20	1.10	1.00	.95	.95
Montrose, Iowa	....	1.50	1.60	1.55	1.45	1.40
Sheboygan, Wis.	1.10	1.10	1.10	1.10	....	....
Southern Illinois	1.35	1.25	1.25	1.25	1.20	....
Stolle, Ill. (I. C. R. R.)	1.30	....	1.35	1.35	1.35	1.35
Toledo, Ohio	1.60	1.70	1.70	1.70	1.60	1.60
Toronto, Canada	1.90	2.25	2.25	2.25	2.00	2.00
			Prices include 90c freight			
Waukesha, Wis.	1.00	1.00	1.00	1.00	1.00	1.00
SOUTHERN:						
Alderson, W. Va.	.75	1.25	1.40	1.25	1.15	....
Bridgeport, Texas	1.10	1.40	1.35	1.35	1.25	1.25
Bromide, Okla.	.75	2.00	1.75	1.60	1.50	1.25
Cartersville, Ga.	1.25	1.75	1.75	1.15	1.15	1.15
Chickamauga, Tenn.	1.00	1.00@1.25	....	1.00@1.25	.90@1.25	....
El Paso, Texas	1.00	1.00	1.00	1.00	....	....
Ft. Springs, W. Va.	.80	1.50	1.50	1.40	1.40	....
Garnet and Tulsa, Okla.	.50	1.60	1.60	1.45	1.45	....
Ladds, Ga.	....	....	1.40	1.40	1.40	....
Morris Spur (near Dallas), Tex.	1.25	1.25	1.40	1.40	1.40	1.25
WESTERN:						
Atchison, Kans.	.50	1.90	1.90	1.80	1.80	1.80
Blue Spr'gs and Wymore, Neb.	.20	1.65	1.65	1.55	1.45	1.40
Cape Girardeau, Mo.	1.35	....	1.10	1.35	1.10	....
Kansas City, Mo.	1.00	1.50	1.50	1.50	1.50	1.50

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.60	1.50	1.35	1.15	1.00	....
Bound Brook, N. J.	1.70	2.10	1.80	1.50	1.40	....
Dresser Jct., Wis.	1.00	2.25	....	1.75	2.00	....
Duluth, Minn.	1.00	2.25	2.00	1.50	1.40	....
E. Summit, N. J.	1.80	2.30	1.90	1.60	1.40	....
Eastern Massachusetts	.85	1.75	1.75	1.40	1.40	1.40
Eastern New York	.75	1.50	1.50	1.30	1.40	1.30
Eastern Pennsylvania	1.25	1.55	1.50	1.40	1.40	1.40
New Britain, Middlefield, Rocky Hill, Meriden, Conn.	.60	1.50@2.00	1.35@1.50	1.15@1.25	1.00@1.10	....
Oakland, Calif.	1.75	1.75	1.75	1.75	1.75	....
Richmond, Calif.	.50*	....	1.50*	1.50*	1.50*	....
San Diego, Calif.	1.80	1.80	1.50@1.80	1.25@1.55	1.25@1.55	1.10@1.35
Spring Valley, Calif.	.70	1.55	1.50	1.40	1.35	1.35
Springfield, N. J.	2.00	2.20	2.20	1.80	1.75	1.60
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Atlanta, Ga.—Granite	1.47	2.07	2.07	1.97	1.97	....
Buffalo, N. Y.—Granite	.90	....	1.20	1.00	1.05	1.10
Berlin, Utley and Red Granite, Wis.	1.60	1.70	1.60	1.50	1.40	....
Columbia, S. C.—Granite	.50	....	2.25	2.00	2.00	....
Dundas, Ont.—Limestone	1.00	1.35	1.35	1.25	1.10	1.10
Eastern Penna.—Sandstone	.85	1.60	1.55	1.35	1.35	1.30
Eastern Penna.—Quartzite	1.20	1.35	1.20	1.20	1.20	1.20
Lithonia, Ga.—Granite	.75	1.75	1.75	1.40	1.40	1.25
Lohrville, Wis.—Cr. Granite	1.35	1.40	1.30	....	1.20	....
Middlebrook, Mo.—Granite	3.00@3.50	....	2.00@2.25	2.00@2.25	....	1.25@1.50
Sioux Falls, S. D.—Granite	1.00	1.60	1.55	....	1.50	....

*Cubic yard. †Agrl. lime. ||R.R. ballast. §Flux. ‡Rip-rap, a 3-inch and less.

Agricultural Limestone
(Pulverized)

Chaumont, N. Y.—Analysis, 95% $CaCO_3$, 1.14% $MgCO_3$—Thru 100 mesh; sacks, 4.00; bulk	2.50
Grove City, Pa.—Analysis, 94.89% $CaCO_3$, 1.50% $MgCO_3$; 60% thru 100 mesh; 45% thru 200 mesh; 100% thru 20 mesh; sacks, 5.00	3.50
Hillsville, Pa.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$, 75% thru 100 mesh; sacks, 5.00; bulk	3.50
Jamesville, N. Y.—Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.00; bulk	2.50
New Castle, Pa.—96% $CaCO_3$ 1.40% $MgCO_3$—75% thru 100 mesh, 94% thru 50 mesh; sacks, 5.00; bulk	3.50
Walford, Pa.—Analysis, 50% thru 100 mesh; 4.50 in paper; bulk	3.00
Watertown, N. Y.—Analysis, 96% **$CaCO_3$; .02% $MgCO_3$; 90% thru** 100 mesh; bulk, 3.00; sacks	4.50
West Stockbridge, Mass., Danbury, Conn., North Pownal, Vt.—Analysis, 90% $CaCO_3$—50% thru 100 mesh; paper bags, 4.75—cloth, 5.25; bulk	3.25
Alton, Ill.—Analysis, 98% $CaCO_3$, 0.5% $MgCO_3$; 90% thru 100 mesh	6.00
Belleville, Ont.—Analysis, 90.9% $CaCO_3$, 1.15% $MgCO_3$—45% to 50% thru 100 mesh, 61% to 70% thru 50 mesh; bulk	2.50
Chasco, Ill.—Analysis, 96.12% $CaCO_3$, 2.5% $MgCO_3$; 90% thru 100 mesh	5.00
90% thru 50 mesh	**1.35**
Detroit, Mich.—Analysis, 88% $CaCO_3$, 7% $MgCO_3$—75% thru 200 mesh, 2.50@4.75—60% thru 100 mesh	1.80@3.80
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 90% thru 50 mesh; 80-lb. paper sacks	5.00
Bulk	3.50
Piqua, Ohio—100% thru 100 mesh; bulk, 5.50; bags	7.00
50% thru 100 mesh; bulk, 2.10; bags	2.25
80% thru 100 mesh; bulk, 3.50; bags	5.00
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; 50% thru 100 mesh	1.50
Hot Springs, N. C.—50% thru 100 mesh; sacks, 4.25; bulk	2.70
Knoxville, Tenn.—75% thru 100 mesh; bulk, 2.70; bags, 3.95; 80% thru 200 mesh; bulk, 3.50; bags	4.75
Linville Falls, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; bulk	2.75
Mountville, Va.—Analysis, 76.60% $CaCO_3$, 22.83% $MgCO_3$—50% thru 100 mesh; 100% thru 20 mesh; sacks	5.00
Colton Calif.—Analysis, 95% $CaCO_3$, 3% $MgCO_3$—all thru 20 mesh—bulk	4.00
Lemon Cove, Calif.—Analysis, 94.8% $CaCO_3$, 0.42% $MgCO_3$; 60% thru 200 mesh; sacks, 5.25; bulk	4.50

Agricultural Limestone
(Crushed)

Alton, Ill.—Analysis, 98% $CaCO_3$, 0.1% $MgCO_3$; 90% thru 50 mesh	1.50
Bellevue, Ohio—Analysis, 61.56% $CaCO_3$, 36.24% $MgCO_3$; ¼ in. to dust, about 20% thru 100 mesh	1.25
Bettendorf, Iowa, and Moline, Ill.—97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Buffalo, Iowa—90% thru 4 mesh	1.00
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; 100% thru 10 mesh, 90% thru 50 mesh	1.50
90% thru 4 mesh, cu. yd	1.35
Chicago, Ill.—Analysis, 53.63% $CaCO_3$, 37.51% $MgCO_3$; 90% thru 4 mesh	.80
Columbia, Ill., near East St. Louis—⅛-in. down	1.25@ 1.80
Elmhurst, Ill.—Analysis, 35.73% $CaCO_3$, 20.69% $MgCO_3$; 50% thru 50 mesh	1.25
Huntington and Bluffton, Ind.—Analysis, 61.56% $CaCO_3$, 36.24% $MgCO_3$; about 20% thru 100 mesh	1.25

(Continued on next page)

Agricultural Limestone

(Continued from preceding page)

Greencastle, Indiana.—Analysis, 98% $CaCO_3$; 50% thru 50 mesh		2.00
Kansas City, Mo.—50% thru 100 mesh		1.50
Krause and Columbia, Ill.—Analysis, 90% $CaCO_3$, 90% thru 4 mesh		1.20
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh		2.00
Screenings (¼ in. to dust)		1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 32% thru 50 mesh; 51% thru 50 mesh; 100% thru 4 mesh; 83% thru 10 mesh; bulk		1.25
Milltown, Indiana.—Analysis, 94.41% $CaCO_3$, 2.95% $MgCO_3$; 33.6% thru 100 mesh, 40% thru 50 mesh	1.25@	1.65
Mitchell, Ind.—Analysis, 97% $CaCO_3$, 1% $MgCO_3$; 50% thru 100 mesh, 90% thru 4 mesh		1.25
Montrose, Iowa.—90% thru 100 mesh		1.25
Narlo, Ohio.—Analysis, 56% $CaCO_3$ 43% $MgCO_3$; limestone screenings, 37% thru 100 mesh, 55% thru 50 mesh, 100% thru 4 mesh	1.50@	2.00
Ohio (different points), 20% thru 100 mesh, bulk	1.25@	1.50
Piqua, Ohio—100% thru 4 mesh		1.25
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@	1.40
Stolle, Ill., near East St. Louis on I. C. R. R.—Thru ⅛-in. mesh		1.30
Stone City, Iowa. — Analysis, 98% $CaCO_3$; 50% thru 50 mesh		.75
Toledo, Ohio.—¼ in. to dust, 30% thru 100 mesh		1.50
Waukesha, Wis.—No. 1 kiln dried		2.00
No. 2 Natural		1.75
Alderson, W. Va. — Analysis, 90% $CaCO_3$; 90% thru 50 mesh		1.75
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; 90% thru 50 mesh		1.50
Cartersville, Georgia.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$—all passing 10 mesh		1.75
Claremont, Va.—Analysis, 92% $CaCO_3$, 2% $MgCO_3$; 90% thru 50 mesh		3.00
50% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh		2.75
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh		1.50
Ladds, Ga.—50% thru 50 mesh		2.00
Garnett, Okla.—Analysis, 80% $CaCO_3$, 3% $MgCO_3$; 50% thru 50 mesh		.50
Kansas City, Mo., Corrigan Siding—50% thru 100 mesh; bulk		1.80
Tulsa, Okla.—90% thru 4 mesh		.50

Miscellaneous Sands

Silica sand is quoted washed, dried and screened unless otherwise stated.

Glass Sand:		
Berkeley Springs, W. Va.	2.25@	2.50
Cedarville and South Vineland, N. J.—Damp, 1.75; dry		2.25
Cheshire, Mass.	7.50@	8.00
Columbus, Ohio	1.50@	2.00
Dunbar, Pa.—Damp		2.50
Falls Creek, Pa.		2.25
Hancock, Md.—Damp, 1.50; dry		2.00
Klondike and Pacific, Mo.	2.00@	2.50
Mapleton, Pa.	2.25@	2.50
Mapleton Depot, Pa.—Dry		2.75
Massillon, Ohio		3.00
Michigan City, Ind.		.50
Millville, N. J. (green)		2.00
Mineral Ridge, Ohio		3.00
Montoursville, Pa.		2.00
Oregon, Ill.		2.50
Ottawa, Ill.		1.50
Pittsburgh, Pa.—Dry, 4.00; damp		3.00
Rockwood, Mich.	2.50@	2.75
Round Top, Md.		2.25
Sands, Pa.		2.50
San Francisco, Calif.	3.00@	3.50
St. Louis, Mo.	2.50@	3.00
Thayers, Pa.	2.00@	2.50
Utica, Ill.	1.40@	1.75
Zanesville, Ohio	2.00@	2.50
Foundry Sand:		
Albany, N. Y.—Molding fine		2.25
Molding coarse		2.00
Sand blast (kiln dried)		4.50
Brass molding		2.25
Allentown, Pa.—Core and molding fine	1.75@	2.00
Arenzville, Ill.—Molding fine	1.50@	1.75
Brass molding	1.75@	2.00
Beach City, Ohio.—Core, washed and screened	2.00@	2.50
Furnace lining	2.50@	3.00
Molding fine and coarse	2.25@	2.50
Cheshire, Mass.—Furnace lining, molding fine and coarse		5.00
Sand blast	5.00@	8.00
Stone sawing		6.00
Cleveland, Ohio.—Molding coarse	1.50@	2.00
Brass molding	1.50@	2.00
Molding fine	1.50@	2.25
Core	1.25@	1.50

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, f.o.b., at producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Attica, N. Y.	.75	.75	.75	.75	.75	.75
Ambridge and So. Heights, Pa.	1.25	1.25	1.25	.85	.85	.85
Buffalo, N. Y.	1.10	.95			.85	
Erie, Pa.	.75		.90		1.10	
Farmingdale, N. J.	.48	.48	.75		1.10	
Hartford, Conn.	.90		1.25	1.15	1.15	1.15
Leeds Junction, Me.	.50	.50	1.50		1.35	1.25
Machias, N. Y.	.75	.75	.85	.85	.85	.85
Pittsburgh, Pa.	1.25	1.25	1.25	.85	.85	.85
Portland, Me.		.50	1.75		1.35	1.35
Washington, D. C. (Rewashed, river)	.75	.75	1.60	1.40	1.20	1.20
CENTRAL:						
Alton, Ill.		.85				
Anson, Wis.	.50	.40				.90
Barton, Wis.	.60	.60	.70	.70	.70	.70
Beloit, Wis.		.70			.80	
Chicago, Ill.		1.75@2.23	1.75@2.43			
Cincinnati, Ohio	.70	.65	.90	.90	.90	.90
Columbus, Ohio	.75@1.00	.75@1.00	.75@1.00	.75@1.00	.75@1.00	.75@1.00
Des Moines, Iowa	.50	.50	1.25	1.60	1.60	1.60
			Unwashed ballast, .50 ton			
Dresden, Ohio	.70	.60	.60		.90	
Earlestead (Flint), Mich.	.70					
Eau Claire, Wis.	.40	.40	1.00@1.25			.85@ .90
Elkhart Lake, Wis.	.66	.60	.76	.76	.70	.70
Ft. Dodge, Iowa		1.22		2.17		
Grand Rapids, Mich.		.50		.80	.70	
Hamilton, Ohio	1.00	1.00	1.00		1.00	
Hawarden, Iowa	.60	.50			1.60	
Hersey, Mich.	.50	.50	.60		.80	.75
Indianapolis, Ind.	.60	.60		1.50	.75@1.00	.75@1.00
Janesville, Wis.		.65@ .75			.65@ .75	
Mason City, Iowa	.70	.65	1.70	1.65	1.65	1.65
Mankato, Minn. (pit run)	.50	.50	.60			1.35
Milwaukee, Wis.	1.11	1.11	1.36	1.36	1.36	1.36
Minneapolis, Minn.	.35	.35	1.25@1.35	1.25@1.35	1.25	1.25
Moline, Ill.	.60@ .80	.60@ .80	1.20@1.50	1.20@1.50	1.20@1.50	1.20@1.50
Riton, Wis.		.40			.60	
St. Louis, Mo., f.o.b. cars	1.20	1.45	1.65	1.45		1.45
St. Louis, Mo., deliv. on job	2.05	2.20	2.35	2.15		2.10
Summit Grove, Clinton, Ind.	.65@ .75	.60@ .75	.60@ .75	.60@ .75	.60@ .75	.60@ .75
Terre Haute, Ind.	.75	.75	.75	.90	.90	.90
Waukesha, Wis.	.50	.50	.80	.80	.80	.80
Winona, Minn.	.40	.40	1.25	1.10	1.10	
			(.05 ton discount 10 days)			
SOUTHERN:						
Atlanta, Ga.	.75	.75		.90	.90	.90
Birmingham, Ala.	1.48		all gravel 1.88			
Charleston, W. Va.	all sand 1.40		all gravel 1.50			
Estill Springs, Tenn.	1.35	1.35		1.00	.85	.65
Ft. Worth, Texas		1.50	1.50	1.50	1.50	1.50
Jackson's Lake, Ala.	.50@ .60	.50@ .60	.40@1.00	1.00	.50@1.00	.50@1.00
Knoxville, Tenn.	.75@1.00	.75@1.00	1.20	1.20	1.20	1.20
Lake Weir, Fla.		.60				
Macon, Ga.		.50@ .75				
Memphis, Tenn.	1.00	1.00	1.80	1.80	1.80	1.80
N. Martinsville, W. Va.	1.00	1.00		1.20	1.00	.80
New Orleans, La.	.25			.85		
Roseland, La.				.85	.85	
WESTERN:						
Grand Rapids, Wyo.	.50	.50	.85	.85	.80	.80
Kansas City, Mo.	(Kaw river sand, car lots, .75 per ton; Missouri river, .85)					
Los Angeles, Calif.		.70	1.20	1.20	1.10	1.10
Pueblo, Colo.	1.10*	.90*		1.50*		
San Diego, Calif.†	.50@ .70	.80@1.00	1.30@1.60	1.35@1.65	1.10@1.40	1.10@1.40
San Francisco, Calif.		1.00	1.00@1.20	.85@1.00	.85@1.00	.85@1.00
Seattle, Wash.	1.25*	1.25*	1.50*	1.25*	1.25*	1.25*
Spring Valley, Calif.	.70	.80	1.40	1.35	1.25	1.25

Bank Run Sand and Gravel

City or shipping point	Fine sand, 1/10 in.	Sand, ¼ in.	Gravel, ½ in.	Gravel, 1 in.	Gravel, 1½ in.	Gravel, 2 in.
Atlanta, Ga.	.30@ .40	.30@ .40				
Boonville, N. Y.	.60@ .80		.55@ .75			1.00
Cape Girardeau, Mo.			River sand, .80 per yd.			
Cherokee, Iowa			.80 per ton—1.20 washed			
Dresden, Ohio		.60				
Dudley, Ky. (crushed sand)	1.00	1.00		.90		
East Hartford, Conn.			.65 per cu. yd.			
Elkhart Lake, Wis.	.70	.50			.60	.60
Estill Springs, Tenn.						.85
Fishers, N. Y.		.50@ .65		.50@ .65		
Grand Rapids, Mich.						.50
Hamilton, Ohio					.70	
Hartford, Conn.		1.00*				
Hersey, Mich.				.55		
Indianapolis, Ind.			Mixed gravel for concrete work, .65			
Lindsay, Texas						.55
Janesville, Wis.		.65			.65@ .75	
Montezuma, Ind.			Road gravel .50 per ton			
Pine Bluff, Ark.			Road gravel .50			
Rochester, N. Y.	.60@ .75	.60@ .75			.50@ .65	.50@ .65
Roseland, La.	.25					
Saginaw, Mich., f.o.b. cars		.75	1.30	1.30	1.30	1.30
St. Louis, Mo.			Bank run gravel 1.55			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.50
Waco, Texas		.80		1.50		1.30
Winona, Minn.	.40	.40	.60	.60		
York, Pa.		1.00@1.20	(crushed rock sand)			

* Cubic yard. B Bank. L Lake. || Ballast. † Low prices, wholesale; high prices, retail.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
E. Canaan, Conn.	4.00	1.00	2.50	1.35	1.25	1.15	1.05
Eastern Penn. and Northern N. J.	2.00	1.20	1.50	1.20	1.20	1.20	1.20
Easton, Pa.	2.50	.80	1.25	.90	.90	.80	.80
Erie, Pa.	Crushed run slag, 4 in. and less, 1.25@1.35						
Emporium, Pa.	....	....	1.35	1.35	1.35	1.35	1.35
Sharpsville and West Middlesex, Pa.	2.00	1.30	1.70	1.30	1.30	1.30	1.30
Western Penn.	2.00	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Chicago, Ill.	All sizes, 1.50, f.o.b. Chicago						
Detroit, Mich.	All sizes, 1.65, f.o.b. Detroit						
Ironton, O.	2.05	1.45	1.80	1.45	1.45	1.45	1.45
Jackson, O.	....	1.35	....	1.35	1.35	1.35	1.35
Steubenville, O.	2.00	1.40	1.70	1.40	1.40	1.40	1.40
Toledo, O.	1.50	1.35	1.35	1.35	1.35	1.35	1.35
Youngstown, Dover, Hubbard, Leetonia, Struthers, O.	2.00	1.30	1.40	1.40	1.30	1.30	1.30
Steubenville, Lowellville, Canton, O.	2.00	1.35	1.60	1.35	1.35	1.35	1.35
SOUTHERN:							
Alabama City, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Ashland, Ky.	....	1.55	....	1.55	1.55	1.55	1.55
Ensley, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Longdale, Goshen, Glen Wilton and Low Moor, Roanoke, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Adams, Mass.	....	....	7.00	....	....	....	2.90	....
Bellefonte, Pa.	....	10.50§	10.50§	10.50§	9.00	....	8.50	1.80
Buffalo, N. Y.	....	....	....	12.50	....	....	....	....
Berkeley, R. I.	....	....	12.00	....	....	....	....	2.30
Cassadaga, N. Y.	Agricultural marl 7.00@10.00							
Chaumont, N. Y.	....	....	....	....	2.50	4.00	....	....
Lime Ridge, Pa.	....	....	....	....	....	....	5.00	....
West Rutland, Vt.	13.50	12.00	....	....	....	....	11.00	3.20
West Stockbridge, Mass.	....	....	....	....	....	....	....	2.25
Williamsport, Pa.	....	....	10.00	....	....	10.00	6.00	....
York, Pa. (dealers' prices)	....	11.50	11.50	12.50	....	....	....	1.85
Zylonite, Mass.	3.20d	2.90d	7.00	....	....	....	....	....
CENTRAL:								
Cold Springs, Ohio	....	11.00	11.00	....	....	....	10.00	....
Delaware, Ohio	12.50	11.00	10.00	12.00	....	....	10.00	1.60
Gibsonburg, Ohio	12.50	11.00	11.00	....	9.00	11.00	10.00	....
Huntington, Ind.	....	11.00	....	....	....	....	....	1.60
Luckey, Ohio	12.50a	11.00	10.00a	....	9.00	....	....	....
Marblehead, Ohio	....	11.00	10.00	....	....	....	10.00	1.60
Marion, Ohio	....	11.00	10.00	....	....	....	10.00	....
Mitchell, Ind.	....	....	....	12.00	11.00	....	10.00	1.60
Sheboygan, Wis.	....	....	....	....	....	....	....	7.50d
White Rock, Ohio	12.50	....	....	....	9.00	11.00	....	....
Woodville, O. (dlrs.' price)	12.50a	11.00a	10.00a	....	9.00	....	10.00	1.60
SOUTHERN:								
Erin, Tenn.	....	....	....	....	....	....	9.00	1.50
El Paso, Texas	....	....	....	....	....	....	9.00	1.50
Karo, Va.	....	....	....	....	....	....	7.00	....
Knoxville, Tenn.	12.50	11.00	11.00	11.00	9.00	....	9.00	1.50
Ocala and Zuber, Fla.	14.00	14.00	....	14.00	....	....	....	1.75
Sherwood, Tenn.	12.50	11.00	11.00	11.00	....	....	8.50	1.50
Staunton, Va.	....	....	....	....	4.50	5.50	8.50	1.35
WESTERN:								
Colton, Calif.	....	....	15.00	....	....	....	19.70	....
Kirtland, N. M.	....	....	....	....	....	....	12.50	....
San Francisco, Calif.	21.50	21.50	15.00	21.50	....	....	18.50	2.40
Tehachapi, Calif.	....	....	....	....	....	....	13.00	2.00

‡100-lb. sacks; *180-lb. net, price per barrel; †180-lb. net, non-returnable metal barrel; §paper sacks. (a) 50-lb. paper bags; terms, 30 days net, 25c per ton or 5c per barrel discount for cash in 10 days from date of invoice; (b) burlap bags; (c) 200-lb. barrels; (d) 280-lb. barrels net.

Miscellaneous Sands

(Continued from preceding page)

Columbus, Ohio.—Core	.50@ 2.00
Sand blast	4.50@ 5.50
Molding fine	2.75@ 3.00
Molding coarse	2.00@ 2.50
Brass molding	2.50
Furnace lining	2.00
Molding coarse	1.75@ 2.00
Stone sawing	1.50
Traction	.70@ 1.00
Delaware, N. J.—Molding fine	2.00
Molding coarse	1.90
Brass molding	2.15
Dunbar, Pa.—Traction, damp	2.50
Dundee, Ohio.—Glass, core, sand blast traction	2.50
Molding fine, brass molding (plus 75c for winter loading)	2.00
Molding coarse (plus 75c for winter loading)	1.75
Eau Claire, Wis.—Core	1.00@ 1.25
Sand blast	3.25@ 3.75
Falls Creek, Pa.—Molding, fine and coarse	1.75
Sand blast	2.00
Traction	1.75
Franklin, Pa.—Core	2.00
Furnace lining	2.50
Molding fine and coarse	2.00
Brass molding	2.00
Greenville, Ill.—Molding coarse	1.30@ 1.50
Joliet, Ill.—No. 2 molding sand and loam for luting purposes; milled	.80
Bank run	.65
Kansas City, Mo.—Missouri river core	.80
Kasota, Minn.—Molding fine	1.60@ 1.85
Molding coarse, stone sawing	1.45@ 1.75
Klondike, Pacific, Gray Summit, Mo.—Molding fine and coarse, stone sawing	2.00
Mapleton Depot, Pa.—Furnace lining, dry	2.75
Molding fine, damp	2.00
Mapleton, Pa. — Glass, core, furnace lining, molding fine and coarse; damp, 2.00; dry	2.75
Massillon, Ohio — Molding fine and coarse, furnace lining, core, traction	3.00
Michigan City, Ind.—Core, traction	.50
Mineral Ridge, Ohio.—Core (green)	2.25
Furnace lining, molding fine and coarse; roofing sand, sand blast, stone sawing, traction brass molding (green)	2.00
Montoursville, Pa.—Core	1.35@ 1.40
Traction	1.00@ 1.10
Brass molding	1.25
New Lexington, Ohio—Brass molding	2.25
Molding coarse	2.00
Oregon, Ill.—Core	1.50@ 2.00
Sand blast	4.00
Stone sawing	2.00@ 2.50
Ottawa, Ill.—Core	1.50@ 2.00
Furnace lining and traction	1.50
Roofing sand	1.75
Sand blast	4.50
Stone sawing	3.00
Brass molding	2.50
Ottawa, Minn.—All crude silica sand	.75@ 1.00
Rockwood, Mich.—Core	1.90@ 2.50
Roofing	2.75
Sand blast	3.75

Miscellaneous Sands

(Continued)

Round Top, Md.—Core (damp)	1.60
Traction (damp)	1.75
Roofing sand	2.25
San Francisco, Calif. (washed and dried)—Core, molding fine, roofing sand and brass molding	3.00@ 3.50
(Direct from pit)	
Furnace lining, molding coarse, sand blast	3.60
Stone sawing, traction	2.30
St. Louis, Mo.—Red heavy molding	1.50@ 2.25
Red fine	1.50@ 2.00
Molding fine and brass	2.00@ 3.00
Skein core	1.75@ 2.25
White core sand	1.00@ 1.75
Sand blast	2.00@ 4.50
Furnace lining	1.50@ 2.50
Sand blast	2.00@ 4.50
Roofing sand	1.00@ 1.50
Stone sawing	1.25@ 2.00
Thayers, Pa.—Core	2.00
Furnace lining, molding fine and coarse	1.25
Traction	2.25
Utica, Ill.—Core, furnace lining, molding fine and coarse, brass molding	.85@ 1.50
Roofing sand and stone sawing	1.40@ 2.50
Sand blast	2.50
Traction	1.40
Warwick, Ohio.—Furnace lining, dry 2.75, green	2.00
Molding fine and coarse, dry 2.75, green	1.75
Traction and brass molding	2.50
Zanesville, Ohio.—Molding fine, brass molding	1.75@ 2.00
Molding coarse	1.50@ 1.75

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Asheville, N. C.—Best white and 200-mesh (per ton)	8.00
Yellow (per ton)	9.00
Red (per ton)	13.00
Baltimore, Md.—Crude talc (mine run)	3.50
Ground talc (20-50 mesh), bags	10.00
Ground talc (150-200 mesh), bags	12.00
Cubes	60.00
Blanks (per lb.)	.08
Chatsworth, Ga.—Grinding	7.00
Ground talc (150-200 mesh); bags	15.00@20.00
Pencils and steel workers' crayons (gross)	1.50@ 2.50
Chester, Vt. — Ground talc (150-200 mesh), bulk	6.50@ 8.50
(Bags 1.00 extra)	
Emeryville, N. Y.—325 mesh (double air floated), bags	14.75
Glendale, Calif. — Ground talc (150-200 mesh)	16.00@30.00
(Bags extra)	
Ground talc (50-300 mesh)	13.50@15.50
200 mesh	13.50@14.50
Hailesboro, N. Y.—Ground talc (150-250 mesh), bags	18.00
Henry, Va.—Crude talc (lump mine run) per 2000-lb. ton	2.75@ 3.50
(150-200 mesh), bags	9.75@12.50
Los Angeles, Calif.—Crude talc f.o.b. Silver Lake	7.00@12.00
Ground talc (150-200 mesh), 100-200 lb. bags)	12.00@14.00
Mertztown, Pa.—Ground talc (20-50 mesh); bulk, 5.00; bags	6.00
(150-200 mesh); bulk, 7.00; bags	8.00
Natural Bridge, N. Y.—Ground talc (150-200 mesh) bags	12.00@13.00
Rochester and East Granville, Vt.—Ground talc (20-50 mesh), bulk	8.50@10.00
(Bags extra)	
Ground talc (150-200 mesh), bulk	10.00@22.00
(Bags extra)	
Vermont—Ground talc (20-50 mesh); bags	7.50@10.00
Ground talc (150-200 mesh); bags	8.50@15.00
Waterbury, Vt.—Ground talc (20-50 mesh), bulk	5.00
(Bags 1.00 extra)	
Ground talc (150-200 mesh), bulk	8.00@14.00
(Bags 1.00 extra)	
Pencils and steel workers' crayons, per gross	1.20@ 2.00

Rock Phosphate

(Raw Rock)

Per 2240-lb. Ton

Centerville, Tenn.—B.P.L. 65%	6.00@ 8.50
B.P.L. 65%	6.00
Gordonsburg, Tenn.—B.P.L. 68-72%	5.50@ 6.50
Mt. Pleasant, Tenn.—Analysis, .65-70% B.P.L. (2000 lb.)	6.50
Paris, Idaho.—2000 lb. mine run, B.P.L. 70%	3.53

(Continued on next page)

Roofing Slate

The following prices are per square (100 sq. ft.) for Pennsylvania Blue-Gray Roofing Slate, f. o. b. cars quarries:

Sizes	Genuine Bangor, Washington Big Bed, Franklin Big Bed	Genuine Albion	Slatington Small Bed	Genuine Bangor Ribbon
24x12	$10.20	$8.40	$8.10	$7.50
24x14	10.20	8.40	8.10	7.50
22x12	10.80	8.70	8.40	7.80
22x11	10.80	8.70	8.40	7.80
20x12	12.60	9.00	8.70	8.10
20x10	12.60	9.00	8.70	8.10
18x10	12.60	9.00	8.70	8.10
18x 9	12.60	9.00	8.70	8.10
16x10	12.60	8.70	8.40	7.80
16x 9	12.60	8.70	8.40	7.80
16x 8	12.60	8.70	8.40	7.80
18x12	12.60	9.00	8.70	8.10
16x12	12.60	8.70	8.40	7.80
14x10	11.10	8.40	8.10	7.50
14x 8	11.10	8.40	8.10	7.50
14x 7 to 12x6	9.30	8.10	7.50	7.50
	Mediums	Mediums	Mediums	Mediums
24x12	$ 8.10	$8.10	$7.20	$5.75
22x11	8.40	8.40	7.50	5.75
Other sizes	8.70	8.70	7.80	5.75

For less than carload lots of 20 squares or under, 10% additional charge will be made.

(Continued from preceding page)

(Ground Rock)

Wales, Tenn.—B.P.L. 70%		7.75
	Per 2000-lb. ton	
Barton, Fla.—Analysis, 50-65% B.P.L.	3.50@	8.00
Centerville, Tenn.—B.P.L., 60-65%		6.50
B.P.L. 75% (brown rock)		12.00
Benotis, Fla.—Analysis 77-82% B.P.L.		8.00
Montpelier, Idaho. — Analysis, 72% B.P.L., crushed and dried		3.75
Mt. Pleasant, Tenn.—B.P.L. 65%	6.50@	7.00
Twomey, Tenn.—B.P.L. 65%		6.50

Florida Soft Phosphate

(Raw Land Pebble)

Per Ton

Benotis, Fla.—Analysis 26-28% phosphoric acid—200 lb. sacks, carload lots	10.00
Jacksonville (Fla.) District	10.00@12.00

(Ground Land Pebble)

Per Ton

Jacksonville, Fla., District	14.00
Add 2.50 for sacks.	
Morristown, Fla.—26% phos. acid	16.00
Mt. Pleasant, Tenn.—65% B.P.L.	5.95

Fluorspar

Fluorspar—80% and over calcium fluoride, not over 5% silica; per ton f.o.b. Illinois and Kentucky mines	22.00
Fluorspar—85% and over calcium fluoride, not over 5% silica; per ton f.o.b. Illinois and Kentucky mines	23.50

Special Aggregates

Prices are per ton f. o. b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco chips
Chicago, Ill.—Stucco chips, in sacks f.o.b. quarries		17.50
Deerfield, Md. — Green; bulk	7.00	7.00
Easton, Pa.—Evergreen, creme green and royal green marble	16.00@20.00	16.00@20.00
Slate granules		7.00
Granville, N. Y.—Red slate granules		7.50
Harrisonburg, Va.—Blk. marble (crushed, in bags)		12.50
Ingomar, Ohio (in bags)	6.00@14.00	10.00@25.00
Milwaukee, Wis.		16.00@32.00
New York, N. Y.—Red and yellow Verona		32.00
Middlebrook, Mo.—Red		25.00@30.00
Phillipsb'g, N. J.—Green stucco dash	16.00@20.00	
Poultney, Vt.—Slate granules		7.50
Red Granite, Wis.		7.50
Sioux Falls, S. D.	7.50	7.50
Tuckahoe, N. Y.—(2000 lb.)		7.00@12.00
Whitestone, Ga.—White marble chips, net ton in bulk, f.o.b., bags 12½c extra	4.50	4.50

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	25.00@35.00
Carpenterville, N. J.	18.50	31.50@41.50
Easton, Pa.	16.00	40.00@60.00
Ensley, Ala.	16.00	26.00
Eugene, Ore.	25.00@26.00	50.00@75.00
Friesland, Wis.	22.00	32.00
Houston, Tex.		19.50
Omaha, Neb.	18.00	30.00@40.00
Portland, Ore. (Del'd)	21.00	45.00@75.00
Puyallup, Wash.	20.00	30.00@75.00
Rapid City, S. D.	18.00	25.00@40.00
St. Paul, Minn.	15.00	30.00@45.00
Salem, Ore.	25.00	35.00@50.00
Salt Lake City, Utah	17.00@18.00	35.00@40.00
Springfield, Ill.	18.00	20.00@25.00
Wauwatosa, Wis.	14.00@15.00	26.00@65.00
Watertown, N. Y.	21.00@22.50	35.00@37.50
Winnipeg, Can.	18.00	26.00

Sand-Lime Brick

Prices given per 1,000 brick f. o. b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	11.00
Boston, Mass.	15.00@16.50
Buffalo, N. Y.	16.50
Dayton, Ohio	12.50@13.50
Grand Rapids, Mich.	12.00
Lancaster, N. Y.	14.00
Michigan City, Ind.	11.00
Milwaukee, Wis. (delivered)	14.00
Minneapolis, Minn.	13.00
Plant City, Fla.	10.00
Rives Junction, Mich.	12.00
Saginaw, Mich.	12.00
San Antonio, Texas	13.00
San Antonio, Texas (deliv. city lts.)	15.00
South Dayton, Ohio	12.50@13.50
Syracuse, N. Y. (delivered at job)	17.00
F. o. b. cars	15.00
Washington, D. C.	14.50

Gray Clinker Brick

El Paso, Texas	13.00

Lime

Warehouse prices, carload lots at principal cities.

	Hydrate per Ton Finishing	Common
Atlanta, Ga.	23.50	15.00
Baltimore, Md.	24.25	17.25
Cincinnati, Ohio	16.80	13.40
Chicago, Ill.	20.00	20.00
Dallas, Tex.	22.50	———
Denver, Colo.	24.00	———
Detroit, Mich.	21.00	20.00
Kansas City, Mo.	28.00	24.00
Minneapolis, Minn. (white)	25.50	21.00
Montreal, Que.	21.00	21.00
New Orleans, La.		
New York, N. Y.	18.20	13.10
Philadelphia, Pa.	16.00	15.00
St. Louis, Mo.	23.20	20.00
San Francisco, Calif.	22.00	16.00
Seattle, Wash. (paper sacks)	24.00	———

Portland Cement

Current prices per barrel in carload lots f. o. b. cars, without bags.

Atlanta, Ga.	2.80
Boston, Mass.	3.18‡
Buffalo, N. Y.	3.03‡
Cedar Rapids, Iowa	2.48
Cincinnati, Ohio	2.54
Cleveland, Ohio	2.46
Chicago, Ill.	2.20
Dallas, Texas	2.25†
Davenport, Iowa	2.43
Denver, Colo.	2.65
Detroit, Mich.	2.48
Duluth, Minn.	2.14
Indianapolis, Ind.	2.41
Kansas City, Mo.	2.45
Los Angeles, Calif. (less 5c discount)	3.26
Milwaukee, Wis.	2.37
Minneapolis, Minn.	2.39
Montreal, Can. (sacks 20c extra)	2.40
New Orleans, La.	2.83
New York, N. Y.	2.80‡
Philadelphia, Pa.	2.96‡
Phoenix, Ariz.	3.70
Pittsburgh, Pa.	2.24
Portland, Ore.	3.05
San Francisco, Calif.	3.03@3.15**
St. Louis, Mo.	2.35
St. Paul, Minn.	2.39
Seattle, Wash.	2.90*
Toledo, Ohio	2.48

NOTE—Add 40c per bbl. for bags.
**+warehouse.
‡Including sacks; 10c bbl. discount 10 days.
*10c bbl. discount.
†Bags 15c.

F.O.B. Mill Prices, Bulk

Buffington, Ind.	1.95
Cincinnati, Ohio	3.00†
Concrete, Wash.	2.60
Dallas, Texas	2.15
Dayton, Ohio	2.85†
Hudson, N. Y.	2.60
Indianapolis, Ind.	2.96†
Los Angeles, Calif.	2.80
Louisville, Ky.	2.92†
Memphis, Tenn.	3.24†
Steelton, Minn.	1.95
Universal, Pa.	2.00

†Including cloth sacks.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco* Calcined Gypsum	Cement‡ and Gauging Plaster	Wood Fiber	White§ Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	Plaster Board ¼x32x36" Weight 1500 lb. Per M Sq. Ft.	Plaster Board ⅜x32x36" Weight 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48" Lengths 6'-10', 1850 lb. Per M Sq. Ft.
Douglas, Ariz.	......	6.00	6.00	......	13.00	......	......	......	......	......	......	......	......
Fort Dodge, Iowa	3.00	3.50	6.00	8.00	10.00	10.50	20.00	......	21.30	20.00	20.00	......	30.00
Garbutt, N. Y.	......	......	6.00	8.00	10.00	10.00	......	7.00	......	......	......	20.00	......
Grand Rapids, Mich.	3.00	......	5.00	10.00	10.00	10.00	......	......	31.00	......	19.75	20.00	30.00
Hanover, Mont.	4.50	......	6.00	10.00	......	10.50	......	......	......	......	......	......	......
Mound House, Nev.	......	8.50	6.50	10.50@11.50	......	......	......	......	......	......	......	......	......
Oakfield, N. Y.	3.00	4.00	6.00	8.00	10.00	10.00	20.20	7.00+	30.75	21.00	19.375	20.00	30.00
Rapid City, S. D.	4.00	......	......	10.00	11.00	11.50	......	......	33.75	......	......	......	......
San Francisco, Calif.	......	......	......	16.40	......	......	......	......	......	......	......	......	......
Winnipeg, Man.	5.50	5.50	7.00	13.50	15.00	15.00	......	......	......	......	28.50	......	35.00

NOTE—Returnable Jute Bags, 15c each, $3.00 per ton; Paper Bags, $1.00 per ton extra.
*Shipment in bulk 25c per ton less; ‡Bond plaster $1.50 per ton additional; +Sanded Wood Fiber $2.50 per ton additional; §White Moulding 50c per ton additional; ‖Bulk; (a) Includes sacks.

News of All the Industry

Incorporations

The Washington Phosphate Co., Colfax, Wash., has been incorporated for $500,000 by H. Treede, G. D. Miles, F. A. Bryant and C. E. Abegglen.

The Seaboard Portland Cement Co., Seattle, Wash., has been incorporated for $3,000,000 by H. Schroeder and J. K. McDowell.

The Riverside Sand and Gravel Co., Everett, Wash., has been incorporated for $10,000 by S. McGee, R. P. Reardon, J. C. Bartholet and J. Brady.

The Duncansville Lime and Stone Co., Duncansville, Pa., has been incorporated for $50,000 by Alice Diehl, J. C. Diehl and J. M. Hazlett.

The Chagrin Valley Sand Co., Cleveland, Ohio, has been incorporated for $10,000 by F. W. Stanton, J. A. Fenner, F. F. Truhlar, A. M. Loveland and W. L. Rose.

The Summit Sand and Gravel Co. has been incorporated in Virginia, Minn., for $50,000 by E. L. Boule and W. K. Montague.

The MacArthur Mfg. Co. has been incorporated for $100,000 by W. MacArthur, 521 Lyon Bldg., Seattle, Wash., and others, to operate stone quarries.

The Humpich Sand Co., Jefferson, Ohio, has been incorporated for $21,000 by B. Humpich, J. P. Herman and F. J. Herman, all of Louisville.

The Lime By-Products Co., Charleston, W. Va., has been incorporated for $500,000 by J. P. Horan, M. F. Matheney, G. L. Hartley, B. J. Pettigrew and H. Green, all of Charleston.

The Massillon Washed Gravel Co., Massillon, Ohio, has been incorporated for $100,000 by S. A. Swanson, W. F. Kutz, O. D. Miller, E. L. McLain and C. E. Swanson.

The Waldo County Agricultural Lime Co., Lincolnville, Maine, has been incorporated for $10,000 by O. W. Ripley, president; A. S. Heal, treasurer, and A. L. Miller.

The Cement Building Products, Inc., Brockton, Mass., has been incorporated for $25,000 by H. L. Sampson, Whitman; W. S. Allen and A. W. Barlow, Brockton.

The Meshberger Bros. Stone Co. has incorporated at Linn Grove, Ind., with a capital of $100,000, $50,000 preferred stock, to operate stone quarries. The directors are H. Meshberger, O. Meshberger and J. Meshberger.

The Temple Silica Sand Co., Reading, Pa., has made application for a charter. W. B. Hunter, C. N. Hunter and W. B. Bertolet will be the incorporators.

The E. Politi Granite Co., Inc., Northfield, Vt., has been incorporated for $50,000 by E. Politi, D. Politi, B. A. Stockwell and H. L. Brusa, all of Northfield.

The Eureka Granite Co., Montpelier, Vt., has been incorporated for $50,000 by G. Seinwright, M. G. Maloney, H. C. Emmons and F. O. Pecue.

The Gosselin Granite Co., Inc., Springfield, Vt., has been incorporated for $25,000 by A. W. LaFontaine, W. D. Woolson and F. G. Gosselin.

The Le Grande Stone Co., Wilmington, Del., has been incorporated for $10,000. The Corporation Service Co. is the attorney.

The Apex Crushed Rock and Sand Co., Apex, Calif., has been incorporated for $225,000, of which $50,000 has been subscribed.

The Sandy Hill Sand Co., 156 Bond street, Paterson, N. J., has been incorporated for $100,000.

Sand and Gravel

The Charles Minick gravel plant, west of Newcastle, Ind., has recently been completed and put in operation to produce washed and graded sand and gravel. As soon as the plant is working good two switches will be laid to the plant, so gravel can be loaded direct from the bins.

The Peerless Flint Gravel Co., south of Douglass, Kans., is doing a rushing business and working day and night. It has trucks, power diggers, big washing plant, narrow gage railway and new appliances for running, washing and loading the gravel.

The Arkansas City sand plant, Arkansas City, Kans., was one of the losers on account of the recent flood in the Arkansas river, as the plant was located on the Frisco west of the city. The company estimates the loss, besides the loss of time and business, at least $1000. Two shacks and a lot of supplies were washed away by the high waters. The company are all ready to go again, however, as soon as the water recedes a little more. It has orders to fill and will be pumping sand and loading it for shipment shortly, it is estimated, provided the water continues to fall. The sand business here has grown to be a large industry and the A. C. Sand Co. ships out the Arkansas river sand for building purposes, all over this section of the country and to many other states as well.

The Yadkin Gravel Co., Lilesville, N. C., has increased its capital stock from $50,000 to $150,000.

The Pioneer Sand and Gravel Co., Seattle, Wash., has purchased a block of tidelands on the East Waterway owned by the Oregon & Washington railway. Unofficially, it is stated the company will utilize the site for the construction of sand, gravel and coal bunkers.

The Sycamore Canyon Gravel Co., Whittier, Calif., is reported to have put off a big blast recently at its quarries. Four tunnels, 400 ft. deep, were drilled and about 30,000 lb. of powder used. About 80,000 to 90,000 cu. yd. of decomposed granite was broken to be used in road building. The cost of the shot was about $8000.

Quarries

Dudley & Orr, El Paso, Texas, have completed installation of new machinery at its rock quarries at Tiffin and begun production on a large scale for Texas & Pacific ballasting work west of Baird, according to C. D. Johnson, general agent of the Texas and Pacific railway.

The Muncie Stone and Lime Co., Muncie, Ind., is working at full capacity to fill orders for various grades of crushed stone for road building.

The Spring River Stone Co., northeast of Carthage, Mo., was destroyed by fire recently of unknown origin. The loss is estimated at $75,000, all of which is covered by insurance. John O'Keefe, manager of the plant, stated the plant will be rebuilt as soon as possible.

The Blue Ridge Stone Corp., Pounding Mill Quarry Corp. and the Pembroke Limestone Corp., Roanoke, Va., recently organized as affiliated companies with combined capitalization of $1,100,000, are considering plans for the installation of electric power equipment, quarrying machinery, crushing and grinding equipment. J. P. Woods is president.

H. G. England, who recently acquired the Shumaker marble works at Marysville, Kans., is moving the plant to Hiawatha, Kans., and will discontinue the business at Marysville.

The Limestone Products Co., Memphis, Tenn., incorporated several years ago for **$200,000, has** been reorganized and will erect a plant to manufacture limestone fertilizer and crushed **stone on** its property near **Black Rock, Ark., it is an**nounced by J. E. Hollingsworth, secretary and manager.

J. L. Sovereign, Keller, Wash., announces that Eastern capital will develop the granite quarries in Ferry county as soon as the land selected has been patented, a total of 160 acres. Mr. Sovereign stated that Illinois and other Eastern capital is behind the proposed development and within a year expect to become a granite shipping center.

The San Antonio Mesa Rock Co. has been formed in Claremont, Calif., by K. Forbes, G. G. Forbes and C. A. Purrington.

Ross, Kelly and Clark of Knoxville, Tenn. have purchased a tract of marble land containing seven varieties and will operate a plant shortly. A spur track is now being laid to the property from the main line of the K. C. G. & L. line.

Lime

The Superior Lime and Hydrate Co., Inc., Pelham, Ala., has commenced the construction of a new hydrate lime-manufacturing plant with capacity of about 500 bbl. per day, estimated to cost close to $100,000 with machinery. A list of equipment to be installed is being arranged. H. C. Bridgewater is secretary and manager.

The Union Lime Co., Los Angeles, Calif., has purchased 6 acres of land on the Southern Pacific's main line in Glendale. The company will build its main office on this property and make other improvements. The total expenditures will amount to $100,000.

The Ash Grove Lime and Portland Cement Co., is installing a new power plant at its factory at Ash Grove, Mo. The plant will be large enough to take care of the company's needs for many years.

The Great Western Portland Cement Co., Mildred, Kans., has installed a lime pulverizer to manufacture agricultural lime.

The Orofino Lime and Fertilizer Co., Orofino, Idaho, has recently been incorporated. It will ship lime rock in its original form or crushed, and may engage in the manufacture of fertilizer and cement. The company has contracts for rock for fertilizer and for use in sugar factories. W. H. Zumwalt is president; C. W. Mathews, vice-president; W. L. Mathews, secretary, and G. D. Zumwalt, Grangeville, Idaho, is treasurer.

Cement

The Ft. Worth Portland Cement Co., Ft. Worth, Texas, has completed tests on land on which it has an option, and will commence construction of a cement plant shortly, it is reported.

The Southwestern Portland Cement Co., El Paso, Texas, has purchased 600 acres of land on Sycamore creek, and plans to erect a plant there.

The Sandusky Cement Co., Toledo, Ohio, will take steps to alleviate the housing shortage at Silica. It will build 10 houses not far from the Silica plant with others contempated in the near future.

The Riverside Portland Cement Co., Riverside, Calif., plans to double the capacity of its plant.

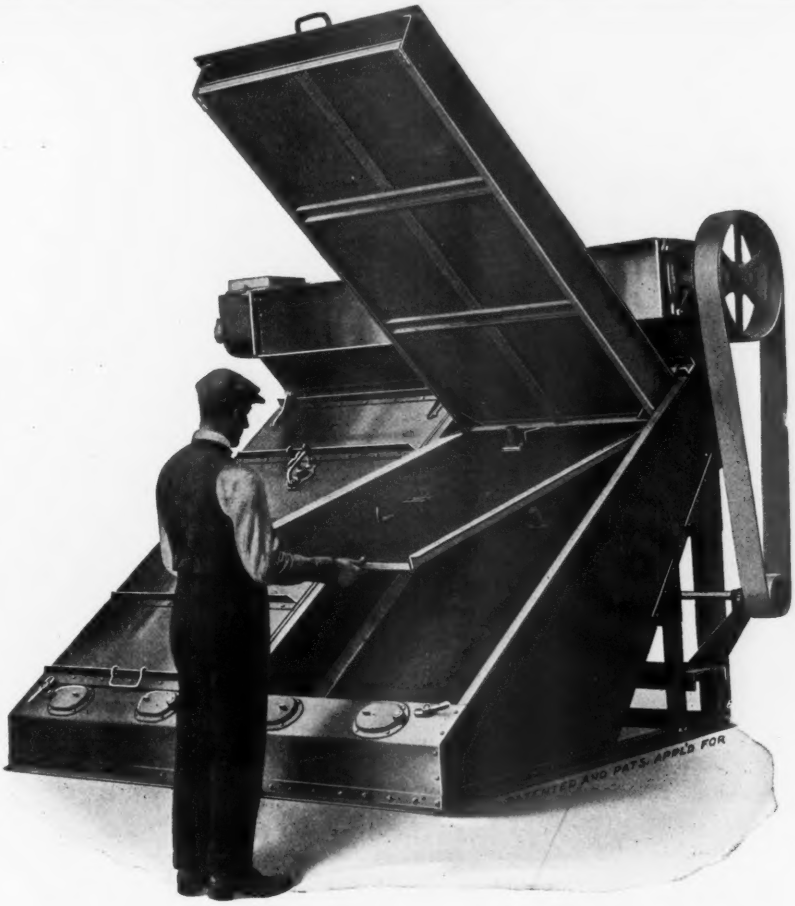
The Kerr Portland Cement Co., Wheeling, W. Va., has secured about 800 acres at Beech Bottom, W. Va., as a site for a new plant with initial capacity of about 3000 bbl. per day. The works will approximate 80 acres of floor space, and will include a power house and machine shop. The estimated cost is placed at $1,300,000.

The International Portland Cement Co., Ltd., Spokane, Wash., has been awarded the contract to furnish 6000 bbl. of cement for use on the Yakima storage project. The amount involved is $20,178.

The Inretnational Portland Cement Co. is about

(Continued on page 88)

STURTEVANT



Better Vibration at Half Price

Vibration is the key to Screen success.
Durability and Accessibility are also obligatory.
If these features were equal, in competing Screens, then price would control.
Superiority in all these essentials, together with our prices, eliminates all competition.
Moto-Vibro Vibration is best because every wire is vibrated its entire length; top, bottom, middle and sides have equal efficiency. No dangerously stretched cloth, no delicate and skillful adjustments, nothing in the way to hinder accessibility and nothing complicated or weak to break or cause trouble. No motor generator to add to the cost and complicate a simple and inexpensive machine.
Moto-Vibro operates electrically, if convenient; otherwise, belt driven.
If simplicity, durability, accessibility, reasonable cost, large, accurate outputs, and "better" vibration appeals to you, send for circular.

STURTEVANT MILL CO. HARRISON SQUARE **Boston, Mass.**

to increase the capacity of its plant at Manchester, Minn., it is reported.

The Bankers Portland Cement Co., Charleston, W. Va., has been incorporated for $5,000,000 by C. M. Croft, B. F. Peabody, O. L. Allen, J. G. Taylor and L. B. Moore. The principal office of the company will be at Charleston and the corporation is to remain in good standing for 50 years. It will engage in general cement work and manufacture and sell cement blocks.

The Huron Portland Cement Co., Detroit, has awarded the general contract to Klug & Smith, engineers, 65 Wisconsin street, Milwaukee, for the construction and equipment of a local storage and distributing plant at Sixth avenue and Burnham street, on the Kinnickinnic river basin. It will cost about $120,000 and require considerable conveyor, hoist and other equipment, including electric motors.

The Manitowoc Portland Cement Co., Manitowoc, Wis., has let initial contracts, amounting to $400,000, for its new cement works, which will cost $1,000,000 and be ready to start production about March 1, 1924. Inquiry is being made for a list of miscellaneous machinery and equipment. The so-called wet process of production will be employed. L. E. Geer is general manager.

Phosphate Rock

The Ft. Smith Fertilizer Co., Ft. Smith, Ark., plans the construction of a power house at its new phosphate plant at Rudy, Ark., where 40 acres has been acquired. It will cost $80,000.

The Read Phosphate Co., Columbia, Tenn., has purchased the phosphate rights on 93,187 acres of land near Mt. Pleasant from J. S. Frierson, G. W. Killebrew for $50,000. Further agreement is made that after the property has been mined or operated for the next 15 years, the parties of the first part agree to sell it outright to the Read Phosphate Co. for $15,000, making the total consideration $65,000. The contract gives the phosphate company all the phosphate rock or sand or phosphate bearing material existing in, on or under the land and the right to operate wagon ways, tramways and railroads and pipe lines.

The Alabama Rock Asphalt Co., Louisville, Ky., has been granted a permit to sell 2500 shares of stock at $100 per share by the Alabama Securities Commission. The company owns rock asphalt deposits in Colbert county, Ala.

The Missouri Rock Asphalt Co., Chillicothe, Mo., has secured a charter from the state and will develop 17,000 acres, leased in Carroll and Livingston county. The state is making an analysis to determine its value as road building material. Negotiations are under way for the building of a $100,000 mill and to obtain a railroad spur to the field, according to H. L. Graham, secretary of the Chillicothe Chamber of Commerce.

The Southern Rock Asphalt Co., Flint, Ala., recently formed with a capital of $600,000, has plans under way for the construction of a local refining plant, estimated to cost in excess of $100,000, with machinery. Equipment for asphalt mining will be installed on local property. L. D. Powell is general manager.

Agstone

Elmer Jackson, who is crushing limestone on a farm west of Burnsville, Ind., for the county roads, is planning on pulverizing stone for agricultural use by farmers of this county, if a total order of 300 tons of material is ordered.

F. O. Underwood, vegetable gardening specialist of State College and O. H. Chapin, manager of the county Farm Bureau, planted a tomato fertilizer demonstration plot on the Foster Lewis farm at Perrysburg, N. Y. The demonstration was arranged for by the farmers of that community, and Mr. Chapin says others will be put on for other communities desiring them and making their wants known.

C. J. Chapman, Madison, Wis., head of the College of Agricuture, gave a talk to farmers on soil testing and the use and production of lime to conserve soil fertility, at Wingville. Many quarries will be tested in that vicinity with the plan of starting a limestone crusher.

Concrete Products

Joseph Supple, Portland, Ore., will erect a concrete products plant to cost $8000.

The Interlocking Tile and Sewer Pipe Co., Ontario, Calif., is perfecting plans for the erection of a new plant in the vicinity of Indio, estimated to cost about $75,000. J. F. Gale and D. E. Bulger head the company.

The Century Cement Products Co., Lyndhurst, N. J., is planning for enlargements in its local plant, to include the installation of additional machinery. The company specializes in the manufacture of blocks, tile and kindred products under a special process. John H. McGuire, Passaic, N. J., mayor of that city, is president and David Slayback, vice-president and treasurer.

The Tile Inlaid Roofing Co., Buffalo, N. Y., has increased its capital stock to $10,000.

The Nevada Magnesite Products Co., Reno, Nev., recently organized, has plans for the construction of new works, about nine miles from Reno, for the manufacture of composition stone products, including hollow blocks, tiles, etc. The plant will include a power house and machine shop and is estimated to cost $100,000 with machinery. C. H. McCarthy is president and Paul Butler, vice-president.

E. M. Galli, Hollister, Calif., operating a local plant for the manufacture of concrete pipe and kindred products, has acquired property on Market street, Salinas, as a site for a new branch plant, for which plans will be prepared at an early date. Joseph Cassi is also interested in the company.

The Cast Stone Products Co., 16 South Eutaw street, Baltimore, Md., will commence the erection of a new plant at 3rd and Maryland avenues, Brooklyn district, for the manufacture of blocks, hollow tile and other cast stone specialties.

The Collins Concrete Pipe Co., Portland, Ore., has been incorporated for $10,000 by J. J. Collins, G. C. Motley, J. B. Finnigan to manufacture concrete pipe, etc. The attorney is Lewis, Lewis & Finnegan, 414 Couch building, Portland.

The Lyon Stucco Co., Springfield, Ill., has been incorporated for $15,000 to compound and manufacture magnesite products, stucco, flooring materials, etc., by E. Lyon, C. Schmidt, H. D. Duncan. Correspondent is T. E. Lyon, 413 Grand boulevard, South Springfield.

C. V. Spickelmier, general manager of the Spickelmier Fuel and Supply Co., announces opening of a concrete products plant to manufacture concrete building tile, etc.

Personal

G. S. Brown, president of the Alpha Portland Cement Co., Easton, Pa., recently gave a talk on the cement industry at a noonday meeting of the Kiwanis Club.

Manufacturers

The B. F. Sturtevant Co., of Hyde Park, Mass., has purchased the plant of the Wisconsin Engine Co., makers of Corliss engines at Corliss, Wis. The new acquisition covers nearly 10 acres and the buildings have about 150,000 ft. of floor space. The plant will be under the same direction as the other company factories—under President Foss. Harry W. Page has been selected as general manager and will be in entire charge of the Wisconsin plant. He is a graduate of the University of Wisconsin. For the past six years he was assistant general manager at the main office of the Sturtevant company at Hyde Park, Boston, Mass.

The Orton & Steinbrenner Co., 608 South Dearborn street, Chicago, manufacturers of locomotive cranes, dipper shovels and grab buckets, announce a reorganization and the election of the following: P. A. Orton, president and genera manager; E. B. Ayers, vice-president; Herbert Mertz, secretary and sales; Harry Shaffer, treasurer and puchasing agent; G. L. Niederst, chief engineer; Alex Orton, works manager. No change in the management, control or policy has been made, nor is any contemplated. The reorganization is occasioned by the resignation of H. G. Steinbrenner as president and the disposal of his interest in the company. The company was organized in 1906; its factory and works are in Huntington, Ind. and main offices in Chicago, with representatives in all the principal cities of the United States and Canada. Beginning with the manufacture of a standard-gage steam locomotive crane, the company has gradually increased its line until at the present time, it manufactures 18 standard models of cranes and dipper shovels—gasoline, electric and steam operated; 10 different types of grab buckets, and 5 styles of coal crushers. The size of the plant has been increased several times and at present work is being pushed rapidly in the construction of a new machine shop which will about double the present capacity.

Trade Literature

Hammer Crushers—Bulletin No. 1005 illustrates and describes the line of heavy-duty steel built hammer mills developed during the past 25 years by the Pennsylvania Crusher Co., Philadelphia, for secondary and finer reductions of limestone, cement, rock, gypsum, shales and similar materials for cement, lime and gypsum plants and other manufacturers employing materials which have to be reduced in this manner. Special emphasis has been laid on the ability of these crushers to automatically eliminate tramp iron from the product without damage to the machinery.

Pavers—Catalog No. 24 of the Koehring Co., Milwaukee, Wis., is an exceptionally well printed and prepared book illustrating and describing the Koehring heavy-duty pavers. Its subjects include the five-action, remixing principle, dominant strength concrete, the heavy-duty drum and drive, main frame and multiplanes, charging skip and super-frame; the No. 21-E paver, 21-E power derrick, high speed automatic boom and bucket system, and many direct applications of its equipment on the job. Drawings and specifications are also included, together with a table of proportions and quantities.

Revised Electrical Supply Catalog—This Westinghouse catalog is regarded as an encyclopedia of things electrical. The former editions have proved so satisfactory that no essential features were altered. It has been indexed according to subjects and to sections, and has a style number and a thumb index. In addition, a classified index has been added. In all, 1300 pages are devoted to descriptive matter, technical data, dimension drawings, specifications and prices. The material includes all new apparatus developed in the last two years. The new issue presents a wider variety of apparatus than any catalog heretofore issued by the Westinghouse Co.

"The Mechanical Mucker" is what the Lake Superior Loader Co., Duluth, Minn., calls its Shuveloder, in a booklet recently issued. The illustrations show actual performances of this company's machinery. Its creed is: "The Shuveloder has been developed to save you money on your mucking costs, to increase your drifting and tunneling speed, and decrease the number of muckers necessary, with the consequent reduction in labor turnover. If it cannot accomplish any one, or all, of these things for you, it has not earned its right to a place on practical jobs."

The bulletin is well illustrated with actual operating photographs and operating reports from different companies where the Shuveloder has been installed. For instance, a report is given on the operation of this machine at the Bay View, Idaho, plant of the International Portland Cement Co. The machine is used for loading limestone. The report goes into detail showing the average loading time per car, the number of men saved by the installation of the Shuveloader, the cost for repair parts and the cost per ton of limestone loaded with this machine.

Gas Producers — The Wellman-Seaver-Morgan Co., Cleveland, Ohio, has issued Bulletin No. 77 dealing with W-S-M Gas Producer Type L No. 8. This gas produced is said to embody many new improvements that have been thoroughly proved in the shop and field. The improvements claimed are that it is self-contained, entirely automatic from coal feed to ash disposal, a simplified driving mechanism, an intermittently rotating ash-pan and a combined steam-jet and turbo-blower. The results claimed from the above improvements are increased mechanical efficiency, increased gas-making capacity, a more uniform quality of gas, no clinkering of the brick liming, elimination of hand-poking and reduced maintenance cost. The bulletin explains all of these points in detail and is well illustrated with photographs and drawings.

IMPORTANT
to the
Gas Producer Operator

The first installation of a Chowning Regulator in a lime plant, the Rockland-Rockport plant, has demonstrated convincingly to many lime people the value of this device.

We have a great number of letters on file that prove that the Chowning Regulator is an absolute necessity with producers in the steel, glass and ceramic industries. Here is what one glass manufacturer has to say:

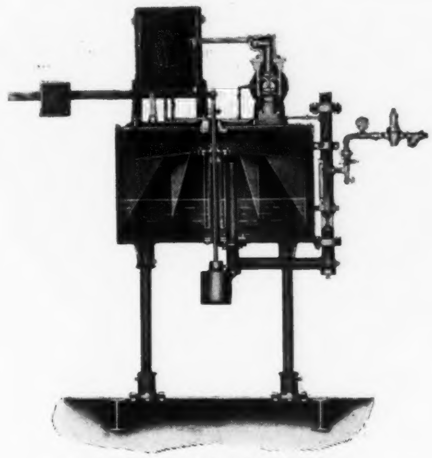
Chowning Regulator Corporation,
Corning, N. Y.

Gentlemen:

With reference to the gas producer regulator, which we purchased last year, we are glad to say that this is one of the best things that we have installed. We believe that it saves us coal, it enables our producermen to know just how often to fire their producers to get maximum results, and last, but the most important of all, the furnacemen and producermen cannot pass the buck between the two, as to why the furnace shows up in its melting capacity.

Anyone who has producers certainly should have your regulator.

Yours very truly,
THE CAMBRIDGE GLASS COMPANY,
(Signed) By J. G. Kelly.



Sectional View of Chowning Regulator

The regulator controls the quantity of gas generated to meet actual requirements.

It is a sheet-steel, oil-tight holder, inclosing a rigidly constructed floating diaphragm, which controls the steam admitted to the blowers.

The recorder permanently records the gas main pressure, enabling the operator to note conditions under which producer is working, and serves as a check for the superintendent.

This regulator can be installed without change of present equipment with the exception of the steam piping and the addition of a pipe connection to the gas main or header. The Chowning pressure regulator will maintain a supply of gas to the furnace not exceeding 1-10 in. water-column variation.

LIST OF USERS

- Bethlehem Steel Co.
- Central Steel Co.
- American Window Glass Co.
- Youngstown Sheet & Tube Co.
- Crucible Steel Co.
- Corning Glass Works
- Kearns-Gorsuch Bottle Co.
- Interstate Window Glass Co.
- Ball Bros. Glass Mfg. Co.
- Dressler Tunnel Ovens (Japan)
- Lukens Steel Co.
- Jones & Laughlin Steel Co.
- Reading Iron Works
- Spang, Chalfont & Co.
- Morimura Bros. (Japan)
- Interstate Iron & Steel Co.
- Worth Steel Co.
- Pittsburgh Plate Glass Co.
- Pittsb'gh Steel Products Co.
- Rockland Lime Corp.
- Crystal Chemical Co.
- Duncan-Miller Glass Co.
- Phoenix Glass Co.
- National Plate Glass Co.
- American Plate Glass Co.
- Encaustic Tile Co.
- U. S. Aluminum Co.
- Chance Bros. (England)
- Hazel-Atlas Glass Co.
- Vereries Mecaniques de Bourgoyne (France)
- Tata Iron & Steel Co., Ltd. (India)

CHOWNING REGULATOR CORPORATION
CORNING, N. Y.

Buyers' Directory
of the Rock Products Industry

Classified Directory of Advertisers in this issue of Rock Products

AERIAL TRAMWAYS
Interstate Equip. Co., New York, N. Y.

AIR COMPRESSORS
Pennsylvania Pump & Compressor Co., Easton, Pa.
Worthington Pump & Mach. Corp., New York City, N. Y.

AIR SEPARATORS
Gay Co., Rubert M., New York City, N. Y.

AUGERS
Howells Mining Drill Co., Plymouth, Pa.

AUTOMATIC WEIGHERS
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.

BABBITT METAL
Ajax Metal Co., Philadelphia, Pa.

BAGS AND BAG MACHINERY
Jaite Co., The, Jaite, Ohio.
Valve Bag Co. of America, Toledo, Ohio.

BALLS (Tube Mill, etc.)
Fuller-Lehigh Co., Fullerton, Pa.

BELTING
New York Belting and Packing Co., New York City.
Robins Conveying Belt Co., New York City, N. Y.

BELT FASTENERS
Crescent Belt Fastener Co., New York City, N. Y.

BINS
Austin Mfg. Co., Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
Weller Mfg. Co., Chicago, Ill. (storage)

BIN GATES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bacon, Earle C., Inc., New York City.
Link-Belt Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Webster Mfg. Co., The, Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

BLASTING SUPPLIES
Atlas Powder Co., Wilmington, Del.
Ensign-Bickford Co., Simsbury, Conn.
Grasselli Powder Co., Cleveland, Ohio.

BRICK MACHINERY
Shope Brick Co., Portland, Ore.

BUCKETS—Elevator
American Manganese Steel Co., Chicago Heights, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
Link-Belt Co., Chicago, Ill.
Orton & Steinbrenner, Chicago, Ill.
Webster Mfg. Co., The, Chicago, Ill.

BUCKETS
Industrial Works, Bay City, Mich.
Jeffrey Mfg. Co., Columbus, Ohio.
McMyler Interstate Co., Cleveland, Ohio.
Penn Fdy. & Mfg. Co., Reading, Pa.
The Byers Machine Co., Ravenna, Ohio.

CABLEWAYS
Interstate Equip. Co., New York, N. Y.
Lidgerwood Mfg. Co., New York, N. Y.
Link-Belt Co., Chicago, Ill.
McMyler Interstate Co., Cleveland, Ohio.

CALCINING MACHINERY
Ehrsam & Sons Co., J. B., Enterprise, Kans.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.

CARS—Quarry and Industrial
Hendrick Mfg. Co., Carbondale, Pa.
Koppel Industrial Car and Equipment Co., Koppel, Pa.
Penn Fdy. & Mfg. Co., Reading, Pa.
Worthington Pump & Mach. Corp., New York City, N. Y.

CAR PULLERS
Link-Belt Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

CASTINGS
McGann Mfg. Co., Inc., York, Pa.

CEMENT MACHINERY
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Traylor Eng. & Mfg. Co., Allentown, Pa.

CHAIN
Carroll Chain Co., The, Columbus, Ohio.
Morse Chain Co., Ithaca, N. Y.

CLUTCHES
Link-Belt Co., Chicago, Ill.
Webster Mfg. Co., The, Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

COAL PULVERIZING EQUIPMENT
Orton & Steinbrenner Co., Chicago, Ill.

CONVEYORS AND ELEVATORS
Austin Mfg. Co., Chicago, Ill.
C. G. Buchanan Co., Inc., New York City, N. Y.
Caldwell, H. W., & Son Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, Ohio.
Link-Belt Co., Chicago, Ill.
Smith Eng. Works, Milwaukee, Wis.
Robins Conveying Belt Co., New York City.
Sturtevant Mill Co., Boston, Mass.
Toepfer & Sons Co., W., Milwaukee, Wis.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Universal Road Mach. Co., Kingston, N. Y.
Webster Mfg. Co., The, Chicago, Ill.

CRANES—Crawler
Industrial Works, Bay City, Mich.
Orton & Steinbrenner Co., Chicago, Ill.
Northwest Eng. Co., Chicago, Ill.

CRANES—Locomotives
Byers Machine Co., Ravenna, Ohio.
Erie Steam Shovel Co., Erie, Pa.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
McMyler-Interstate Co., Cleveland, Ohio.
Northwest Eng. Co., Chicago, Ill.
Ohio Locomotive Crane Co., Bucyrus, Ohio.
Orton & Steinbrenner, Chicago, Ill.
Osgood Co., The, Marion, Ohio.
Northwest Engineering Co., Chicago, Ill.

CRUSHERS AND PULVERIZERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Austin Mfg. Co., Chicago, Ill.
Bacon, Earle C., Inc., New York, N. Y.
Buchanan Co, Inc., C. G., New York, N. Y.
Ehrsam & Sons Co. J. B., Enterprise, Kan.
Fuller-Lehigh Co., Fullerton, Pa.
Good Roads Machinery Co., Kennett Square, Pa.
Gruendler Pat. Cr. & Pulv. Co., St. Louis, Mo.
Jeffrey Mfg. Co., Columbus, Ohio.
K. B. Pulverizer Co., New York, N. Y.
McLanahan-Stone Mach. Co., Hollidaysburg, Pa.
Morgan Engineering Co., The, Alliance, Ohio.
New Holland Machine Co., New Holland, Pa.
Pennsylvania Crusher Co., Philadelphia, Pa.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Robins Conveying Belt Co., New York City, N. Y.
Smidth & Co., F. L., New York, N. Y.
Smith Eng Works, Milwaukee, Wis.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Universal Crusher Co., Cedar Rapids, Iowa.
Universal Road Mach. Co., Kingston, N. Y.
Webb City & Carterville Fdy. and Mach. Wks., Webb City, Mo.
Worthington Pump & Mach. Corp., New York City, N. Y.

CRUSHER REPAIRS—Manganese Steel
American Manganese Steel Co., Chicago Heights, Ill.

DERRICKS
American Hoist & Derrick Co., St. Paul, Minn.
The Byers Machine Co., Ravenna, Ohio.
Lidgerwood Mfg. Co., New York, N. Y.
Orton & Steinbrenner Co., Chicago, Ill.

DIPPER TEETH
American Manganese Steel Co., Chicago Heights, Ill.

DRAGLINES
Orton & Steinbrenner Co., Chicago, Ill.
Northwest Eng. Co., Chicago, Ill.

DREDGES—Bucket and Elevator Type
Ellicott Machine Corp., Baltimore, Md.
Osgood Company, Marion, Ohio.

DRILLS
Howells Mining Drill Co., Plymouth, Pa.

DRILLS—Blast Hole
Armstrong Mfg. Co., Waterloo, Iowa.
Howells Mining Drill Co., Plymouth, Pa.
Sanderson Cyclone Drill Co., Orrville, Ohio.

DRILL STEEL
Colonial Steel Co., Pittsburgh, Pa.

DRYERS
American Process Co., New York City.
Buckeye Dryer Co., The, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
McGann Mfg. Co., York, Pa.
Steacy-Schmidt Co., New York, N. Y.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

TOEPFER

Combination Scrubber *and* Screen

Out of the wealth of Toepfer engineering and manufacturing experience has come this combination scrubber and screen representing a value little short of revolutionary.

It is the culmination of years of preparation in rendering a greater service to the non-metallic minerals industry. With the production of this machine, the Toepfer organization has learned how to surpass itself, and for those who seek a machine of the highest caliber for quantity production, the value expressed in this unusual machine leaves literally no choice but the Toepfer.

It uses less power, less water, and less space than any other type of scrubber. Its construction is simple and durable. There is nothing to get out of order or make trouble.

W. TOEPFER & SONS COMPANY
Milwaukee - - - - - Wisconsin

Buyers' Directory
of the Rock Products Industry
Classified Directory of Advertisers in this issue of Rock Products

Weller Mfg. Co., Chicago, Ill.
Worthington Pump & Mach. Corp., New York City, N. Y.

DUST COLLECTING SYSTEMS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Gay Co., Rubert M., New York City, N. Y.

DYNAMITE
Atlas Powder Co., Wilmington, Del.
Du Pont Powder Co., Wilmington, Del.
Grasselli Powder Co., Cleveland, Ohio.

ENGINES (Gasoline and Kerosene)
Climax Engineering Co., Clinton, Iowa.

ENGINES—Steam
Ellicott Machine Corp., Baltimore, Md.
Morris Mach. Works, Baldwinsville, N. Y.

ENGINES—Oil
Power Mfg. Co., Marion, Ohio.

ENGINEERS
Bacon, Earle C., Inc., New York, N. Y.
Buchanan Co., C. G., Inc., New York City.
Ehrsam & Sons Co., J. B., Enterprise, Kans.
Kritzer Co., The, Chicago, Ill.
Meade & Co., Richard K., Baltimore, Md.
R. W. Hunt & Co., Chicago, Ill.
Smidth & Co., F. L., New York, N. Y.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.
Webster Mfg. Co., The, Chicago, Ill.

EXCAVATORS—Dragline Cableway
Link-Belt Co., Chicago, Ill.
Northwest Engineering Co., Chicago, Ill.
Sauerman Bros., Chicago, Ill.

EXPLOSIVES
Atlas Powder Co., Wilmington, Del.
Du Pont Powder Co., Wilmington, Del.
Grasselli Powder Co., Cleveland, Ohio.

FUEL OIL SYSTEMS
Best Furnace & Burner Corp., W. N., New York, N. Y.
Smokeless Oil Burner Co., Bucyrus, Ohio.

FUSES (Detonating and Safety)
Ensign-Bickford Co., Simsbury, Conn.

GAS PRODUCERS
Morgan Construction Co., Worcester, Mass.
Wood & Co., R. D., Philadelphia, Pa.

GEARS
American Manganese Steel Co., Chicago Heights, Ill.
Caldwell, H. W., & Son Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, Ohio.
Link-Belt Co., Chicago, Ill.

GENERATORS
Burke Electric Co., Erie, Pa.

GREASE
Keystone Lubricating Co. The, Philadelphia, Pa.

GRIZZLIES
Robins Conveying Belt Co., N. Y. City, N. Y.
Traylor Eng. & Mfg. Co., Allentown, Pa.

GYPSUM-PLASTER PLANTS
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.

HOISTS
American Hoist & Derrick Co., St. Paul, Minn.
Hyman-Michaels Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York, N. Y.
Link-Belt Co., Chicago, Ill.
The Byers Machine Co., Ravenna, Ohio.
Thomas Elevator Co., Chicago, Ill.
Vulcan Iron Works, Wilkes-Barre, Pa.
Weller Mfg. Co., Chicago, Ill.

HOSE—Water, Steam, Air Drill, Pneumatic Tool
New York Belting and Packing Co., New York City.

HOSE APPLIANCES
Knox Mfg. Co., Philadelphia, Pa.

HYDRATING MACHINERY
Glamorgan Pipe & Fdy. Co., Lynchburg, Va.
Hendrick Mfg. Co., Carbondale, Pa.
Kritzer Co., The, Chicago, Ill.
Meade & Co., Richard K., Baltimore, Md.
Miscampbell, H., Duluth, Minn.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.
Toepfer & Sons Co., W., Milwaukee, Wis.

HYDRAULIC DREDGES
Ellicott Machine Corp., Baltimore, Md.
Morris Machine Works, Baldwinsville, N. Y.

INSULATION—Heat
Celite Products Co., Chicago, Ill.

LIME HANDLING EQUIPMENT
Kritzer Co., The, Chicago, Ill.
Link-Belt Co., Chicago, Ill.
Webster Mfg. Co., The, Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

LIME HARDENER
Schaffer-Alles Chemical Co., Pittsburgh, Pa.

LIME KILNS
Glamorgan Pipe & Fdy. Co., Lynchburg, Va.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
Hendrick Mfg. Co., Carbondale, Pa.
McGann Mfg. Co., York, Pa.
Meade & Co., Richard K., Baltimore, Md.
Steacy-Schmidt Co., New York, N. Y.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.
Worthington Pump & Mach. Co., N. Y. City, N. Y.

LOADERS AND UNLOADERS
Erie Steam Shovel Co., Erie, Pa.
Industrial Works, Bay City, Mich.
Jeffrey Mfg. Co., Columbus, Ohio.
Link-Belt Co., Chicago, Ill.
Northwest Eng. Co., Chicago, Ill.
Orton & Steinbrenner, Chicago, Ill.
Ottumwa Box Car Loader Co., Ottumwa, Iowa.

LOCOMOTIVES
Baldwin Locomotive Works, The, Philadelphia, Pa.
Davenport Locomotive Wks., Davenport, Iowa.
Fate-Root-Heath Co., Plymouth, Ohio.
Porter Co., H. K., Pittsburgh, Pa.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
Ironton Engine Co., Ironton, Ohio.
Lima Locomotive Works, New York, N. Y.
Milwaukee Locomotive Mfg. Co., Milwaukee, Wis.
Vulcan Iron Works, Wilkes-Barre, Pa.
Whitcomb Co., Geo. D., Rochelle, Ill.

LOCOMOTIVE CRANES
McMyler Interstate Co., Cleveland, Ohio.

LUBRICANTS
Keystone Lubricating Co. The, Philadelphia, Pa.

MAGNETIC DEVICES
Magnetic Mfg. Co., Milwaukee, Wis.

MANGANESE STEEL
American Manganese Steel Co., Chicago Heights, Ill.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.

MILLS (Grinding, etc.)
Fuller-Lehigh Co., Fullerton, Pa.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.

MOTORS, ELECTRIC
Burke Electric Co., Erie, Pa.

PERFORATED METALS
Cross Eng. Co., Carbondale, Pa.
Harrington & King Perforating Co., The, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

PLASTER MACHINERY
Ehrsam & Sons Co., J. B., Enterprise, Kans.

PORTABLE CONVEYORS
Jeffrey Mfg. Co., Columbus, Ohio.
Link-Belt Co., Chicago, Ill.
Ottumwa Box Car Loader Co., Ottumwa, Iowa.

POWDER
Atlas Powder Co., Wilmington, Del.
Grasselli Powder Co., Cleveland, Ohio.

PULLEYS
Weller Mfg. Co., Chicago, Ill.

PULVERIZED FUEL EQUIPMENT
Raymond Bros. Impact Pulv. Co., Chicago, Ill.

PUMPS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Manganese Steel Co., Chicago Heights, Ill.
Ellicott Machine Corp., Baltimore, Md.
Evinrude Motor Co., Milwaukee, Wis.
Morris Machine Works, Baldwinsville, N. Y.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Worthington Pump & Mach. Corp., New York City, N. Y.

PUMP VALVES
New York Belting and Packing Co., New York City.

QUARRY EQUIPMENT
Traylor Eng. & Mfg. Co., Allentown, Pa.
Universal Road Mach. Co., Kingston, N. Y.

REGULATORS
Chowning Reg. Corp., The, Corning, N. Y.

ROAD MACHINERY
Austin-Western Road Machy. Co., Chicago, Ill.
Good Roads Machinery Co., Kennett Square, Pa.
Northwest Eng. Co., Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.

SCRAPERS, DRAG
Austin-Western Road Mchy. Co., Chicago, Ill.

Buyers' Directory
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Link-Belt Co., Chicago, Ill.
Northwest Eng. Co., Chicago, Ill.
Sauerman Bros., Chicago, Ill.

SCREENS

Austin Mfg. Co., Chicago, Ill.
Buchanan Co., Inc., C. G., New York City, N. Y.
Cross Eng. Co., Carbondale, Pa.
Harrington & King Perforating Co., The, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
Kent Mill Co., Brooklyn, N. Y.
Link-Belt Co., Chicago, Ill.
Newark Wire Cloth Co., Newark, N. J.
Smith Eng. Works, Milwaukee, Wis.
Sturtevant Mill Co., Boston, Mass.
Toepfer & Sons Co., W., Milwaukee, Wis.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Tyler Co., The, W. S., Cleveland, Ohio.
Universal Road Mach. Co., Kingston, N. Y.
Universal Vibrating Screen Co., Racine, Wis.
Webster Mfg. Co., The, Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

SEPARATORS

Gay Co., Rubert M., New York City, N. Y.
Kent Mill Co., Brooklyn, N. Y.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.
Tyler Co., The W. S., Cleveland, Ohio.

SEPARATORS, MAGNETIC

Buchanan Co., C. G., Inc., New York, N. Y.
Magnetic Mfg. Co., Milwaukee, Wis.

SHEAVES

American Manganese Steel Co., Chicago Heights, Ill.
Gay Co., Rubert M., New York City, N. Y.
Weller Mfg. Co., Chicago, Ill.

SHOVELS—Steam, Electric and Gas

Bucyrus Co., South Milwaukee, Wis.
Erie Steam Shovel Co., Erie, Pa.
Hoar Shovel Co., Duluth, Minn.
Marion Steam Shovel Co., Marion, Ohio
Northwest Engineering Co., Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Osgood Co., The, Marion, Ohio.
Thew Shovel Co., Lorain, Ohio.

SPROCKETS AND CHAIN

American Manganese Steel Co., Chicago Heights, Ill.
Link-Belt Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

STEEL PLATE CONSTRUCTION

Hendrick Mfg. Co., Carbondale, Pa.

TANKS, STEEL STORAGE

Hendrick Mfg. Co., Carbondale, Pa.
Traylor Eng. & Mfg. Co., Allentown, Pa.

TESTING SIEVES AND SHAKERS

Hendrick Mfg. Co., Carbondale, Pa.
Tyler Co., The W. S., Cleveland, Ohio.

TRACK EQUIPMENT

Central Frog & Switch Co., Cincinnati, Ohio.
Koppel Ind. Car & Equip. Co., Koppel, Pa.

TRANSFORMERS

Burke Electric Co., Erie, Pa.

TRANSMISSION MACHINERY

Kritzer Co., The, Chicago, Ill.
Link-Belt Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

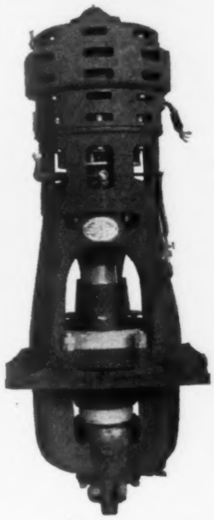
VALVE COUPLINGS

Knox Mfg. Co., Philadelphia, Pa.

WASHERS, SAND AND GRAVEL

Link Belt Co., Chicago, Ill.
Smith Eng. Works, Milwaukee, Wis.

The Weston Direct Drive Gyratory Crusher for Secondary Reduction of Hard Rock, Ore and Gravel



Developed in a Granite Crushing Plant

This machine fills the need for a secondary crusher of large capacity and great strength for work in all friable rock.

The first machine, installed more than two years ago, has established remarkable records for capacity, low power consumption and general economy in operation. Later installations have more than proved all claims for the machine.

The construction is all-steel with Chrome-Vanadium forged steel shaft of large size, and with full-bearing eccentric, bronze bushed inside and out.

The entire machine is arranged to give freedom from costly delays. Positive lubrication without pumps—Dust prevention in bearings—Greater wear on manganese before replacement—Ease of adjustment and repair—and a sturdy oversize motor—All work to your advantage.

Crusher is simple in design and the best practice in modern Engineering is utilized. Built in six standard sizes to follow any primary, smallest machine can be set to ½" with large capacity.

Arranged for direct motor, or belt drive.

Bulletin No. 25-A describes this machine in detail

THE MORGAN ENGINEERING COMPANY

ALLIANCE, OHIO

Designers, Manufacturers and Contractors
Electric Traveling Cranes, Rolling Mill Machinery
Ordnance, Steel, Shipbuilding and Forging Plants Complete
Rock Crushers, Special Machinery for Any Purpose

Chicago
122 S. Michigan Ave.

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1420 Oliver Bldg.
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TRADE MARK REGISTERED
KOPPEL
U.S. PATENT OFFICE

Koppel Hinged Type Square Box Dump Cars

For Quarry Service and Steam Shovel Loading

The large door opening—the substantial door construction — the pressed steel diaphragms in the underframe — the double spring suspended bearings are some of the features which make these cars operate easily, ride the track smoothly and stand up under the strain of steam shovel service.

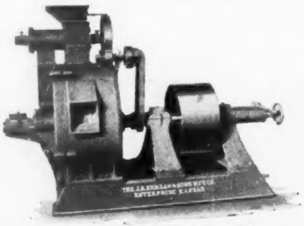
Write for our bulletins

Koppel Industrial Car & Equipment Company, Koppel, Pa.

Sales Offices:

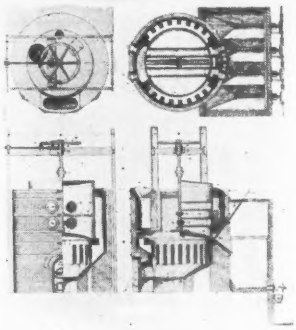
New York **Pittsburgh** **Chicago** **Detroit** **Kansas City** **Philadelphia** **San Francisco**

These fine grinding mills are made in two sizes. A 36-in. Vertical Mill arranged for belt or direct connected motor drive, and a 42-in. Horizontal Mill for belt drive. They are fitted with American, French Burr or Rock Emery Stone.



Vertical Grinding Mill

EHRSAM



Calcining Kettles

Ehrsam Calcining Kettles are made in standard sizes: 4x4 ft., 5x5 ft., 6x6 ft., 8x8 ft., 10 x 8 ft., 12x8 ft., and 14x8 ft. They are complete with the exception of Brick Setting.

We also manufacture Hair and Fibre Pickers, Elevators and Conveying Machinery, Hammer and Revolving Screens, Power Transmission Machinery.

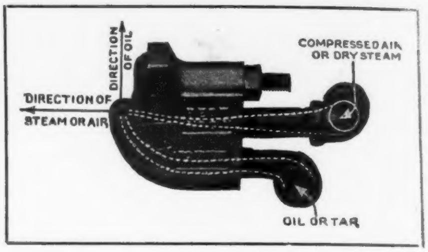
Inquiries Given Immediate Attention

The J. B. Ehrsam & Sons Mfg. Company
Enterprise, Kansas

CALOREX

LIQUID FUEL EQUIPMENT

"Trade-Mark Registered U. S. Pat. Off."



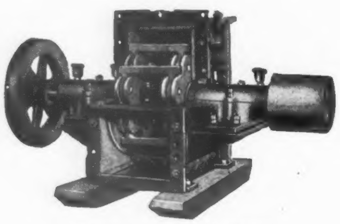
"Calorex" is the liquid fuel equipment that has solved the fuel problem.

It is now giving increased efficiency in many industries and is beyond question the ideal system for lime and cement kilns.

The use of this equipment will increase the tonnage of your locomotive 15 per cent over coal.

Write for complete information.

W. N. Best Furnace & Burner Corp.
11 Broadway New York City, N. Y.



Manganese Steel Linings

USERS OF

"K-B" PULVERIZERS

requiring additional tonnage are ordering "K-B" equipment.

May we tell you why?

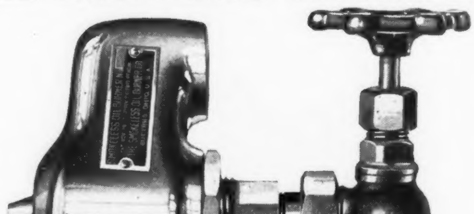
K-B PULVERIZER

K-B Pulverizer Co., Inc.
92 Lafayette Street
New York

BETTER LIME—CEMENT—GYPSUM

Produced With

THE SMOKELESS OIL BURNER



No soot or carbon deposited on material

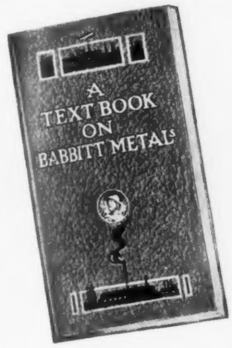
It burns all the fuel because it atomizes every drop of fuel and puts it into the fire-box or kiln broken up into a perfect mist.

The "Smokeless" is ideal for boilers, dryers and all steam equipment where oil can be used as fuel. Readily installed at a slight expense.

Let our engineers investigate your proposition

TANKS—PUMPS—METERS—STRAINERS

The Smokeless Oil Burner Co.
Bucyrus, Ohio
St. Louis Office, 2140 Railway Exchange Building



FREE!

This is yours for the asking!

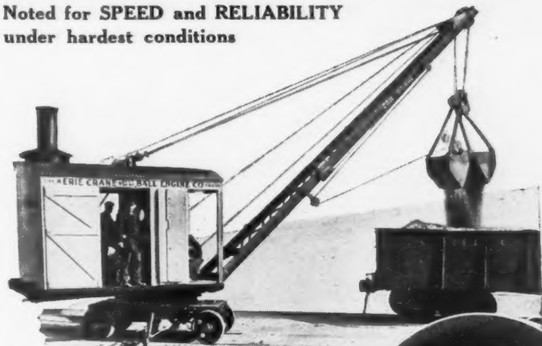
This book tells you the best babbitt for every purpose—tells you why. It doesn't hamper the choice with big words, test tables, co-efficients of friction or degrees of hardness. It has the real dope on the use of babbitt metals—gives you a few friendly tips on how to make the best possible job—tells you many things you probably never thought of—and, in short, solves any babbitting problem you'll meet with.

Write for it on your business letterhead

THE AJAX METAL COMPANY
ESTABLISHED 1880
PHILADELPHIA

New York Chicago Boston Cleveland

Noted for SPEED and RELIABILITY under hardest conditions



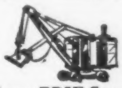
When you need extra output

This machine saves you money even when it is working at only one-fourth capacity, and replacing only 10 or 12 men—

And when you have ***rush orders,*** and are working your plant to the limit, your ERIE Crane can give results like these:

"We loaded 300 tons of sand in 2 hrs. and 10 mins., digging 3 to 8 ft. below track level. This time included moving from car to car.

"This is too speedy, but we wanted to know what our ERIE Crane can do."—W. B. Manny, President, Hoosier Slide Sand Co., Michigan City, Ind.



Every ERIE Crane can be quickly and easily changed to steam shovel.

Let us send full description of the ERIE Crane. Write for Bulletin P-30.

Erie Steam Shovel Co., Erie, Pa., U. S. A.
Builders of ERIE Steam Shovels and Locomotive Cranes

ERIE Revolving Shovels

Osgood Heavy Duty Steam Shovels

Have you seen one of them at work? A regular giant for digging. Easy to operate—low operating and maintenance cost—and fast. Will go most anywhere. Has interchangeable trucks and can be converted, easily and quickly, to Clamshell or Dragline.

¾ and 1 yd. capacities
Ask for Bulletin

The OSGOOD Company
MARION, OHIO, U. S. A.

Flirting With the Shovels

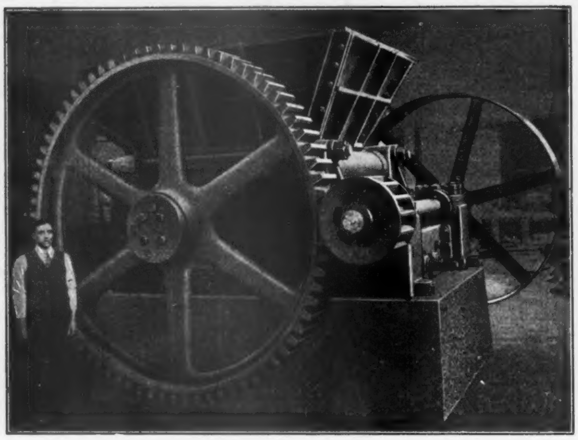
In the game of crushed stone quarrying a drill that is within flirting distance with steam shovel or the loading gangs is in a dangerous position. A breakdown on the drill, and the whole production schedule is upset.

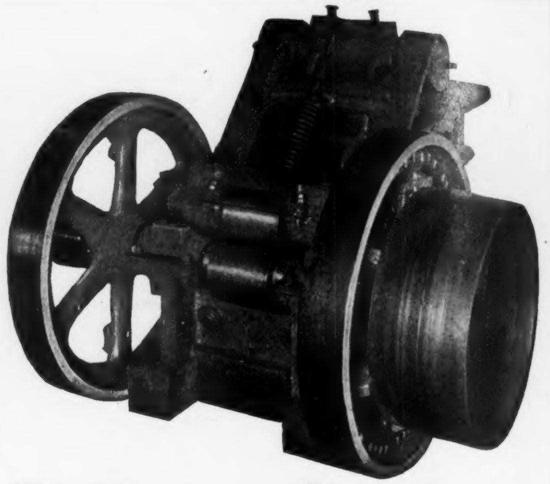
No. 14 Cyclone Drills, on the job, always keep plenty of stone ahead, and if they should ever be crowded there is no need for worry—the working parts are cast steel, reducing to the very minimum all possibility of breakdowns.

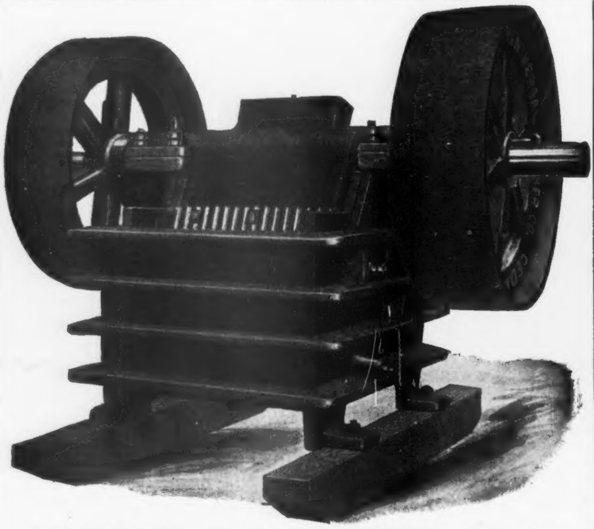
Write for "Big Blast Hole Drills," a semi-technical treatise on quarry drilling and also containing a complete description of Cyclone No. 14 Big Blast Hole Drills.

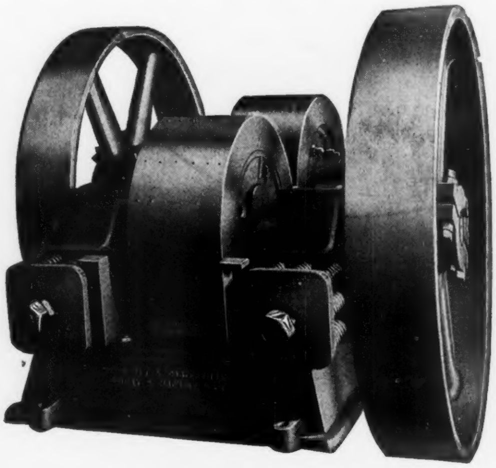
The Sanderson-Cyclone Drill Co.
Orrville, Ohio

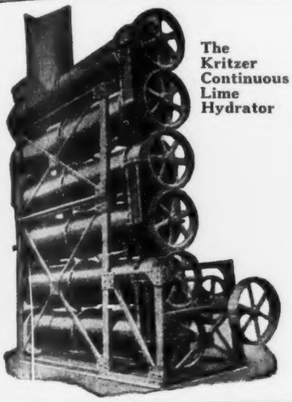
Eastern and Export Office: 30 Church Street, New York City











The Kritzer Continuous Lime Hydrator

HYDRATE

Years ago we helped our customers create a demand for their hydrate. Today the demand exceeds the supply. That's why every lime manufacturer should have an efficient, economical hydrating plant.

THE KRITZER Continuous Lime Hydrator is efficient in production and economical in operation and maintenance. Let us investigate exhaustively the local conditions peculiar to your proposition, and then apply our experience of many years and design a plant to meet those conditions.

A KRITZER plant, scientifically adapted to your conditions, will give you the best product at lowest cost

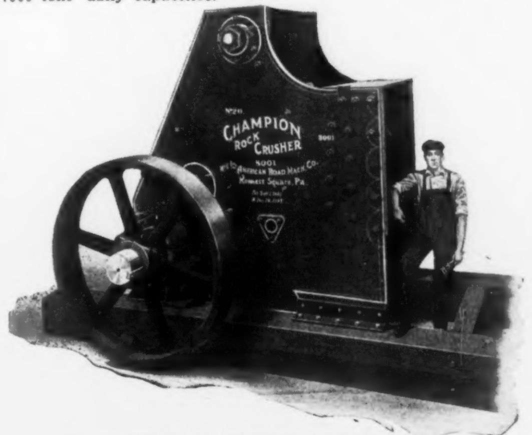
THE KRITZER COMPANY

503 South Jefferson Street CHICAGO, ILL.

Thirty Two Years Ago

The First Champion Crusher Was Built

Since that time more than 6,000 crushers have been sold and users are to be found in every country in the world. The Champion is a slow speed, steel frame crusher, with a large capacity and low upkeep cost. Made in many sizes from 50 to 1000 tons' daily capacities.



No. 20 (22 by 50) Champion Steel Rock Crusher

We design, build and install complete crushing outfits of any size desired. We specialize in the building of Elevators, Screens, and Conveyors of any desired capacity.

Ask for catalogue, "Champion Crushing and Quarrying Machinery." It is free.

THE GOOD ROADS MACHINERY CO., INC.

1203 Tower Building, Chicago, Ill. Kennett Square, Pa.

YORK LIME KILNS

Practical experience and knowledge of requirements are necessary in order to design and construct a kiln that will produce proper results.

We have the co-operation of the foremost lime and hydrating engineers in the country. When we build we use the best material, and the construction contains the features that will always produce results.

We also manufacture Dryers, Gas Producers, Hydrators, Rotary Screens, Tanks, Grey Iron Castings, and Special Machinery from Engineers' Designs.

McGann Manufacturing Company, Inc.

Works, York, Pa.

332 S. Michigan Ave., Chicago 50 Church St., New York

GAYCO EMERICK

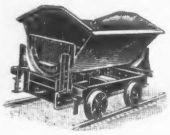
CENTRIFUGAL SEPARATOR

A Dependable "AIR-SCREEN" for sizing Fibrous, Flaky or Granular Materials

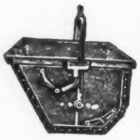
Write Us for Particulars

60 mesh to 350 mesh

RUBERT M. GAY COMPANY **114 Liberty St., New York, N. Y.**



Industrial Cars
and
Dumping Buckets
of All Kinds



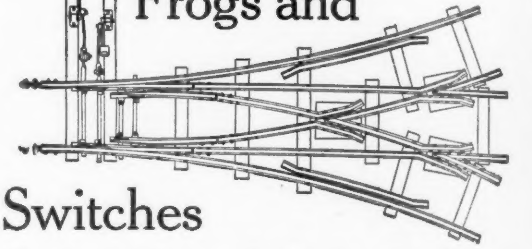
Specialize in

Hoppers, Bins, Bin Gates, Chutes

Penn Foundry & Manufacturing Company

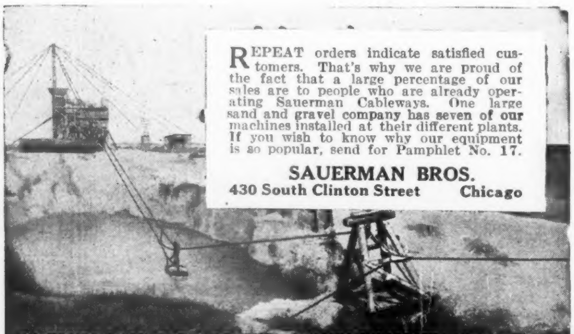
Hillcrest, Reading, Pa.

Frogs and Switches



The Central Frog & Switch Co., Cincinnati, O.

Frogs, Switches, Crossings, Switch Stands, Rails, Angle Bars, Fish Plates, Throws, Rail Braces, Tie Plates, Portable Track, Etc., Etc.



REPEAT orders indicate satisfied customers. That's why we are proud of the fact that a large percentage of our sales are to people who are already operating Sauerman Cableways. One large sand and gravel company has seven of our machines installed at their different plants. If you wish to know why our equipment is so popular, send for Pamphlet No. 17.

SAUERMAN BROS.
430 South Clinton Street Chicago

SAUERMAN DRAGLINE CABLEWAY EXCAVATORS
dig, convey, elevate and dump in one operation

THE STANDARD OF EXCELLENCE

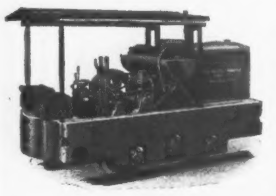
BALDWIN
Industrial and Contractors' LOCOMOTIVES

are in use where dependable motive power is required.

Full information upon request

The Baldwin Locomotive Works
PHILADELPHIA

AMERICAN



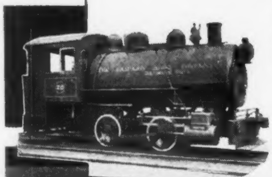
GASOLINE LOCOMOTIVE

They will positively reduce your haulage costs to the minimum, not only because the operating costs are low, but because they are strong, sturdy machines, insuring a continuous service performance that eliminates costly shut-downs.

Write for Descriptive Literature

The Hadfield-Penfield Steel Co., Bucyrus, Ohio

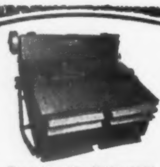
PORTER



Porter Locomotives—for fifty years the leading Quarry Locomotives of the world.

H. K. PORTER COMPANY
Union Bank Bldg.
Pittsburgh, Penna.

LOCOMOTIVES



Type 31, 6-ft HUM-MER

HUM-MER *Electric* SCREEN

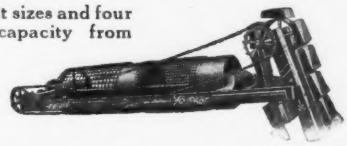
Makes screening and crushing more profitable. Screens any material, wet or dry, from 2½" opening to minus 200 mesh.

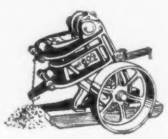
Send for Catalogue 45-R

THE W. S. TYLER COMPANY
CLEVELAND, OHIO
Manufacturers of Woven Wire Screens and Screening Equipment

New Holland Revolving Screens

made in three different sizes and four different lengths — capacity from one to two hundred tons per hour.





Write for catalog and prices on revolving screens, jolt screens, elevators, conveyors, and primary or secondary rock crushers.

NEW HOLLAND MACHINE COMPANY
New Holland, Pa., U. S. A.

Free Service to Readers of

Rock Products

If you are in the market for any kind of machinery, equipment or supplies, or if you desire catalogs, information or prices on any product, we are at your service—to obtain for you, without expense, catalogs, prices or specific information on every kind of machinery, equipment and supplies—or to help you find the hard to find source of supply.

RESEARCH SERVICE DEPARTMENT

ROCK PRODUCTS, 542 So. Dearborn St., Chicago, Illinois

Please send me catalogs and prices concerning the following items:

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Name..

Address..

City...State...

Used Equipment

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Type ads only. No cuts or illustrations permitted unless at the regular display advertising rates. Please send check with order. These ads must be paid for in advance of insertion

FOR SALE

5 5x6x7x110' Rotary KILNS.
5 5x21' Tube Mills (1 has Silax Lining, 3 Steel Lining, 1 without Lining).
2 No. 8 Ball Mills.
1 4x40' Coal Dryer.
1 No. 6 Gates Crusher.
2 5½x22' Smidth Tube Mills.
2 No. 66 Smidth Kominuters.
2 6x60' Rotary Dryers.
1 Lathe, 26" Swing, 16' Bed.
2 Automatic Weighing Machines.
3 Roll Leather Belting, 3-ply, 46"x 242'. And lot of Miscellaneous Equipment.

ENGINEERING SALES COMPANY
Stockertown, Pa.

FOR SALE

1—6K Gates Crusher.
1—4B Gates Crusher.
15—4½-5 ton steel body, end dump, heavy duty, Standard gauge quarry cars.
1—Locomotive. Standard gauge.
1—70 ton Steam Shovel, 2½ yard bucket.

All in good working order.
Will sell at very low price.

Inland Crushed Stone Co.
105 North Clark St. Chicago, Ill.

Immediate Delivery
Power Equipment

1— 20 H.P. Muncie Oil Engine
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1—100 H.P. Nordberg Oil Engine
2— 80 H.P. Fairbanks-Morse Oil Engines
1— 22 H.P. Foos Gas or Gasoline Engine
3— 35 H.P. Bessemer Gas Engines
1— 80 H.P. Rathbun Gas Engine
1—135 H.P. Bessemer Gas Engine
1—150 H.P. Bessemer Gas Engine
6—Corliss Steam Engines—80 to 500 H.P.
12—Slide Valve Steam Engines—8 to 80 H.P.
1—40 H.P. Gasoline Hoisting Engine
6—New "Little Tugger" Air Hoists
5—Belt Driven Air Compressors
6—Steam Driven Air Compressors

Machinery & Supply Corp.
Dept. 27 Joplin, Mo.

1—50-ton standard gauge Brooks 6-wheel switcher.
1—28-ton standard gauge Shay geared locomotive.
2—10x16" 36" gauge 4-wheel saddle tank locomotives.
2—9x14" 36" gauge 4-wheel saddle tank locomotives.
1—14-B Bucyrus steam shovel, mounted on traction wheels.
2—18-ton O&S bucket handling locomotive cranes.
10 Miles 30-lb. and 35-lb. relay steel rails, Natalbany, La.

Birmingham Rail and Locomotive Co.
Birmingham, Ala.

Machinery For Sale

DRYERS—Direct-heat rotary dryers, 3x25', 3½x25', 4x30', 5½x50', 6x60' and 7x60'; double shell dryers, 4x20', 5x30' and 6x35'; steam-heated air rotary dryers, 4x30' and 6x30'.

KILNS—Rotary kilns, 4x40', 5x50' and 6x70', 6x100', 7x80' and 8x110'.

MILLS—6x8', 6x5', 5x4', 3x3½' pebble and ball mills; 3' March mill; 42", 33" and 24" Fuller-Lehigh mills; 4½x20', 5x11', 5x20', 5½x22' and 6x20' tube mills; 7½x13", 9x15", 16x10" and 12x26" jaw crushers; one "Infant" No. 00, No. 0, No. 2, No. 3, and No. 9 Williams' swing hammer mills; one Kent type "G" mill; 24", 36" and 40" cage mills; 3' and 4½', 6' and 8' Hardinge mills; 18x12", 20x12" and 30x10" roll crushers; No. 0, No. 1 and No. 3 Sturtevant rotary crushers; one No. 2 Sturtevant ring roll crusher; 5 roll and 2 roll No. 1 and No. 000, No. 00 and No. 0 Raymond mills; one No. 3 and No. 4 and No. 7½ Telsmith breaker; one 36" Sturtevant emery mill; one 3 roll Griffin mill; 60" chaser mill.

SPECIALS—Five automatic package weighing machines; jigs; 6x8', 6x5' and 4x3' Newaygo vibrating screens; Richardson automatic scales; 8' and 10' Emerick air separators.

Air compressors.

W. P. Heineken, Engineer
95 Liberty Street, New York. Tel. Cortland 1841

FOR SALE

One 14x18 Erie Automatic Tangy Engine, one heater and 50 ft. of 4½" piping.

The North Indiana Brick Co.
Michigan City, Indiana

CRUSHER

1—24x48 Buchanan jaw, manganese fitted, in the best of condition, ready to ship from Jersey City, N. J., with all necessary new spares at one-third of new price.

T. H. Letson Company
50 Church Street New York

FOR SALE

One Sullivan Compressor, size 12 x 10, 248 cubic feet.

Bethesda-Blue Granite Co.
Southern Building Washington, D. C.

ROTARY DRYERS
30 New Direct Fired Rotary Dryers
4 ft. 0 in. diameter, 30 ft. long

These Dryers were about to be put into operation as the Armistice was signed, and consequently were never used. We are offering them at a sacrifice, complete with driving mechanism, furnace irons, grates, etc. Some are equipped with steam radiators for steam heated air drying.

McDERMOTT BROS CO.
Allentown, Penna.

WANTED

Thirty carriers for 20 inch conveyor belt together with 10 return rollers for same belt. Address

Beloit Sand & Gravel Company
607 Forest City Bank Bldg., Rockford, Illinois

FOR SALE

1—4½'x30' American Process Dryer.
1—10½" x 12" Brown, Double Drum Steam Hoist.

Consolidated Products Co.
15 Park Row, New York City

60 lb. and 20 lb. Rails

A-1 Relayers with angle bars; no "Contractors" rails, but good, clean, straight stock; no "broom ends" or "ground bends." 75 tons of these fine Relayers, all long sections; bargain. Also 50 tons select 20 lb. Relayers, all long sections, with flat bars. And some switches, frogs, crossovers, etc.

GENERAL EQUIPMENT CO.
Gridley Bldg. Syracuse, N. Y.

Classified Advertising

Rates for advertising in the Classified Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Type ads only. No cuts or illustrations permitted unless at the regular display advertising rates. Please send check with order. These ads must be paid for in advance of insertion

Competent and Energetic Supt.

open for position. Knowledge of the business gained from actual experience in personally handling plant and quarry work in detail. Thoroughly familiar with installation, operation and maintenance of crushing and quarrying machinery and with development of plants and quarries. Can assure efficient and economical operation. Willing to locate anywhere if future prospects favorable. Address

Box 1673, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

POSITION WANTED

First-class executive of long experience in erection and operation of stone crushing and sand and gravel plants seeks connection as manager or superintendent taking full charge. Excellent references. Address

Box 1672, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

WANTED

Superintendent for Glass Sand plant. Practical man understanding quarry and mill, with some business experience. Give age, references and salary expected in reply. Address

Box 1667, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

Position Wanted

By Cement plant superintendent with mechanical ability, construction and operating; 20 years' experience in wet and dry plants, 18 years' experience as General Foreman and Superintendent, now employed in the Lime Manufacture. Desires change. Excellent references.

Box 1669, Care of Rock Products
542 South Dearborn St. Chicago, Ill.

Situation Open

Superintendent of quarrying, crushing and screening plant, thoroughly experienced, handling large single operation including steam shovels.

Address Box 1674, care Rock Products
542 South Dearborn St., Chicago, Illinois

WANTED

Superintendent for crushed gravel plant. State experience, references, age and salary when making reply.

Address Box 1675, care of Rock Products
542 South Dearborn St., Chicago, Illinois

Southern Negro Labor Supplied

Advance orders taken. Correspondence invited.

PARKER & CO.
309 East 39th Street, Chicago

WANTED

Contract to move dirt overburden from limestone. Have electric equipment to handle 300 yards per hour—at low cost.

W. E. HAMILTON
753 E. Broad St. Columbus, Ohio

POSITION WANTED

An experienced cement manufacturer, technically and commercially trained in all details of financing, operating and selling, desires suitable connection. If interested full information will be furnished.

Address P. M. 200, care Rock Products
542 South Dearborn Street Chicago, Illinois

Position Wanted

Young man, college graduate, with 15 years all round, practical manufacturing and executive experience, including cost accounting, is looking for an opening where he can eventually become directly associated with the management of the business. The last two years he was plant manager of a small hydrated lime plant. Full information on request.

Address Box 1676, care of Rock Products
542 South Dearborn Street Chicago, Illinois

WANTED

Working superintendent for a lime plant in Massachusetts. Must be a good executive and have thorough knowledge of lime burning, rock crushing and general machinery used in the business. Apply with full particulars.

Box 1670, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

Take advantage of the Opportunity offered in the Used Equipment Department to dispose of the equipment that you no longer need.

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